# AMERICAN MACHINIST

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.


## King's Combination Independent Chuck.

The cut herewith illustrates a lathe chuck, in which a piece can be worked, either concentric or eccentric, and in which any desired point on the piece being turned or bored can be accurately and quickly brought into a central position with the mandrel of the lathe, without shifting or loosening the piece in the chuck.

The construction and operation of the chuck will be understood from the following: *A* represents the front portion of the body of the chuck, to which the jaws *F* are attached by means of bolts *C*, having screw nuts on the outer end, for convenience of reversing the jaws. The inner ends of the bolts are T-shaped, and take bearings on the inner side of part *A*, and are driven forward and backward by independent screws, *b*, which work through bolts, *c*. *B* represents the rear portion of the body of chuck, which is so constructed as to lock over the part *A*. The locking joint is fitted slightly beveling, so that when drawn tightly together with bolts *a*, the parts become perfectly solid. The bolts *a* have on their outer end a screw nut. The inner ends have a T-shaped head, which fits into a circular T-shaped groove, formed in the part *B*, which, as shown in the cut, is graduated into degrees, each of which is equal to 1-360th part of the entire circumference of the chuck. By loosening the nuts on bolts *a*, the index point on part *A* can be set to any desired division of the circle.

The sliding plate *C* is dovetailed through the rear side of part *B*, and clamped in any desired position by gib *D*, having tightening screws with countersunk heads. The sliding plate *C* is graduated into fractional parts of an inch, as shown at *e*, on each end, and adjusted by the driving screw *d*, which runs through the entire length of the plate *C*, working through a threaded nut well secured to part *B*, centrally located, in order that the sliding plate may have an equal adjustment in either direction, which in a 6-inch chuck is $2\frac{1}{4}$ inches. The face of the chuck is also graduated into fractional parts of an inch, as at *g*, and on the same side and at the same distance from joint of each jaw is a vertical line, in order that each jaw may be readily adjusted to the same radius.

When the chuck is concentric, the orifice *I* extends entirely through the chuck. The sleeve *J* is securely fitted in the center of the chuck, and forms a bearing for the inner end of driving screws *b*. As is shown by the figures, the cylindrical graduation commences at *o h*, and runs to 90° each way, making 180 graduations, so that the chuck is graduated exactly half way around, thereby enabling the operator to accurately rotate his work to any desired degree or division of the entire circle: and by the use of the graduated sliding plate *C* (which is secured to the mandrel of the lathe in the ordinary way), any point within the range of the chuck may be quickly brought to the center of the mandrel of the lathe, or the position of the piece being worked may be changed to any extent without loosening the work in the chuck until the turning, or boring, is completed.

The jaws *F* are made with biting surfaces on each end, and can be easily reversed when so desired.

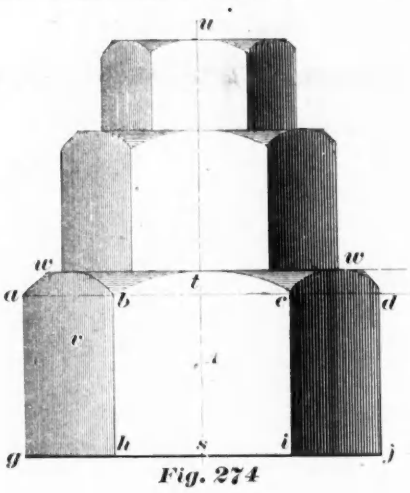



Fig. 274

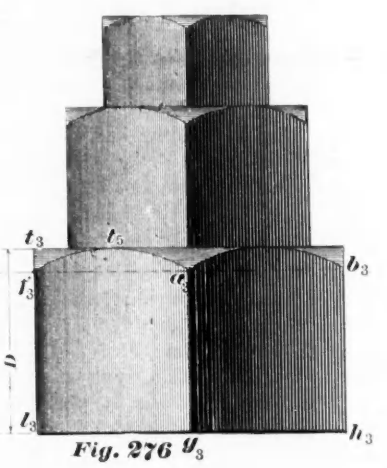



Fig. 276

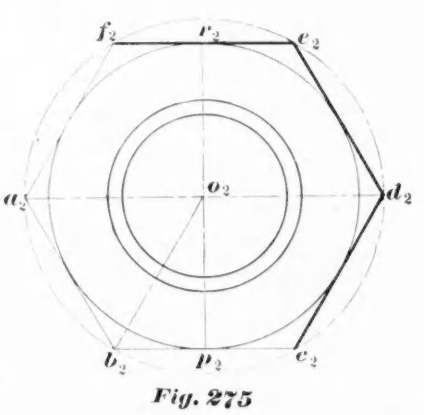



Fig. 275

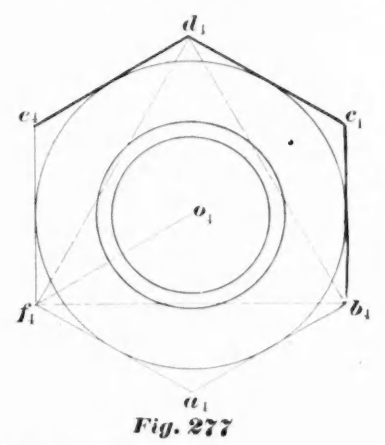
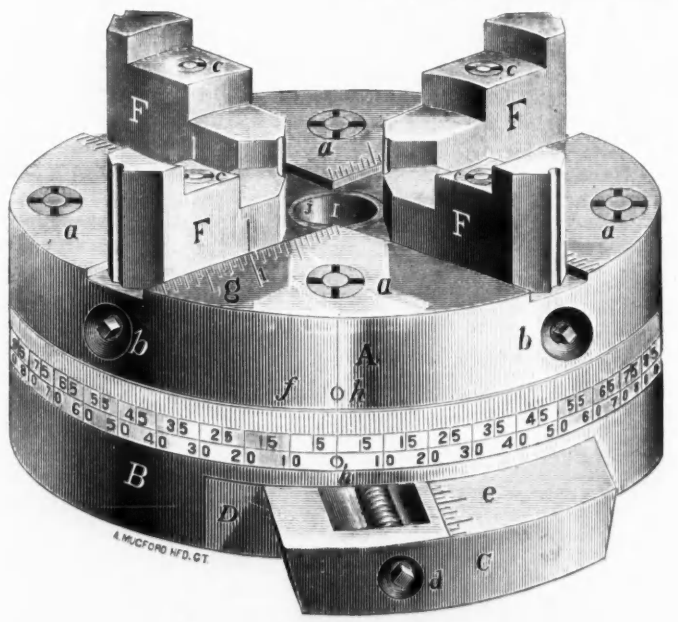



Fig. 277

PRACTICAL DRAWING.

It is thought by the manufacturers that there are many special jobs, in doing which a chuck like this can be profitably used. At present only one size of these chucks is made, viz., six inch; other sizes will no doubt be made, should the demand seem to warrant it. The manufacturers are The E. Horton & Son Company, Windsor Locks, Conn.




COMBINATION INDEPENDENT CHUCK.

A correspondent writes us to say that taking the exhaust from a steam engine back into the boiler, and so saving the greater part of the heat, is not impossible, as he thinks we assume in the AMERICAN MACHINIST of Dec. 17. On the contrary, he asserts that he has all the plans and specifications for doing so, handed down from a prominent engineer of Magdeburg, who, he says, before his death constructed a steam engine to work on this plan.

We are skeptical as to any steam engine ever having been made to work successfully upon this plan. There are patents in this country covering alleged means of returning the exhaust to the boiler, and it is possible that an engine may be made to turn over under such circumstances, but we do not believe in the probability of getting power economically in that way. However, if our correspondent knows exactly how to do it at the saving contemplated, he will have no trouble in marketing the engines he may build. We are skeptical, but wish him success.

## Practical Drawing.

BY J. G. A. MEYER.

FORTY-FIRST PAPER.

*Problem* 53.

380. TO DETERMINE THE DIMENSIONS OF BOLT HEADS AND NUTS, AND THEIR PROJECTIONS.

It frequently happens that in drawings of machinery, the nuts and heads of bolts must be shown, and often, in general plans, a great number of nearly all sizes must be drawn. If the heads of bolts and nuts need not to be of any special size, then the draftsman should know how to determine the standard size of the nuts and heads of bolts for any given diameter of bolt. In general plans, particularly when these are made to a small scale, the dimensions of these heads and nuts are only shown approximately to their true size, but yet there is a limit beyond which the draftsman must not go. It is therefore necessary and very important that the student should know how to determine the dimensions of heads and nuts quickly and correctly; and also, in order to save time in making a drawing, how far he can go beyond the absolute accuracy in drawing the heads and nuts. It is also important that the student should remember how to obtain the sizes without referring to any books or printed rules, and this object, we believe, is best attained by studying the underlying principles. We therefore deem it necessary to present this subject more minutely than its simplicity would seem to justify.

381. Unless some special conditions compel us to show heads and nuts in some particular position, they are always shown in one of the two following positions: First, they may be shown with two of their sides parallel to the plane of projection; in this case their projections will appear like that of the nuts in Fig. 274; secondly, they may be shown with two of their sides perpendicular to the plane of projection; in this case their projections will appear like that of nuts in Fig. 276. The former manner of representing a nut or head is always to be preferred, because it distinctly shows that a hexagon nut is meant; whereas, if shown as in Fig. 276, it may lead to mistakes, as some persons, unless they are thoroughly familiar with drawing, may believe it to represent a square nut instead of a hexagon nut. In a future paper we will point out how a mistake of this kind can be avoided; at present we shall only consider the projections of hexagon nuts.

382. It will be noticed that in Fig. 274, three sides of each nut are seen. When they are shown in this position the following rule holds good in all cases and for all sizes of hexagon nuts: The width *b c* of the side *b c h i*, shown in the center of the nut, must be equal to twice the width *a b* of the side *a b g h*, or twice the width *c d* of the side *c d i j*. From the foregoing we learn that the width of the side, shown in the center of a hexagon nut, must be always equal to one-half the distance across corners, and that the width of each one of the other two

sides must be represented as being equal to one-quarter of the distance across corners. That this is correct in all cases can be proved in the following manner: Let the hexagon $a_2\ b_2\ c_2\ d_2\ e_2 f_2$ (Fig. 275) represent a plan of the nut marked *A* in Fig. 274; $o_2$ the center of the nut from which the circumference of a circle is circumscribed about the hexagon. The line $b\ h$ and the point $b_2$ must lie in one vertical line, because they are the projections of one and the same edge; and the same may be said of the line $c\ i$ and the point $c_2$; hence the width $b\ c$ must be equal to the length of the line $b_2\ c_2$. Now, the distance between $a_2$ and $d_2$ (across corners) is equal to the diameter of the circle whose circumference is circumscribed about the hexagon, and $o_2\ b_2$ is a radius of the same circle. In Art. 190 it has to be shown that radius $o_2\ b_2$ is equal to $b_2\ c_2$ or any other side of the hexagon, and therefore the width of the side $b_2\ c_2$ must be equal to one-half the diameter $a_2\ d_2$, or, in other words, equal to one-half the distance across corners.

Again, the point $b_2$ and the line $b\ h$ are the projections of one edge of the nut; the point $a_2$ and the line $a\ g$, $c_2$ and $c\ i$, also $d_2$ and $d\ j$ are the projections of the other edges of the nut; that is, of those edges which can be seen in the vertical projection. If now we draw a line $o_2\ p_2$ through the center $o_2$ perpendicular to $b_2\ c_2$, the former will bisect the latter, and therefore the distance between the lines $a\ g$ and $b\ h$ must be equal to the distance between the lines $c\ i$ and $d\ g$.

383. It will also be well to notice the fact that in Fig. 274, the face or side $b\ c\ h\ i$ represents the true width and depth of each side of the hexagon nut; the faces $a\ b\ g\ h$ and $c\ d\ i\ j$ also represent the true depth, but not the true width of the sides of the nut, because these faces are shown foreshortened. The same remarks apply to the projection of any other sized nut, large or small, when it is represented as occupying a position in which two of its sides are parallel to the plane of projection.

384. If the same nut is represented in a manner as shown in Fig. 276, in which two of its sides are perpendicular to the plane of projection, then the edge $a_3\ g_3$ will be midway between the outer edges $f_3\ l_3$ and $b_3\ h_3$, and the distance between the outer edges $f_3\ l_3$ and $b_3\ h_3$ will be less than that between the outer edges $a\ g$ and $d\ j$ in Fig. 274.

The question now arises, What shall be the distance between the edges $f_3\ l_3$ and $b_3\ h_3$ of a nut for any given diameter of bolt? To this we answer, the distance between the edges $f_3\ l_3$ and $b_3\ h_3$, which is equal to what the mechanic would call "the distance across the flats" should be made to conform to the Franklin Institute standard, or the United States standard.

These dimensions for bolt heads and nuts, as well as pitch and angle of threads, were proposed by Mr. Wm. Sellers and adopted as a standard in 1864 by the Franklin Institute of Philadelphia. It has also been adopted by the principal machinists of this country, and is generally known by the Franklin Institute or the American standard. The same standard with one slight change was adopted by the U. S. Navy Department 1868, and is called the United States standard. The change or difference between the two standards is this: In the U. S. standard all dimensions of a rough nut are equal to those of a finished nut for a given diameter of bolt; in the Franklin Institute standard the dimensions for finished nut are $\frac{1}{16}$ of an inch less than those of a rough nut.

According to these standards the depth *D* of a rough nut should be equal to the diameter of the bolt and the distance between any two parallel sides; that is, the distance from $f_3\ l_3$ to $b_3\ h_3$ (Fig. 276) should be equal to the sum of the diameter of the bolt, plus one-half of the diameter, plus $\frac{1}{8}$ of an inch. Thus, for a bolt 1 inch in diameter, the depth of the nut should be 1 inch, and the distance between $f_3\ l_3$ and $b_3\ h_3$ should be equal to 1 inch $+$ $\frac{1}{2}$ inch $+$ $\frac{1}{8}$ inch $= 1\frac{5}{8}$ inch. In a similar manner the dimensions of a nut for any other given diameter of bolt can be obtained.

385. The dimensions of the bolt head are exactly equal to those of the nut, with the exception of the depth, which is less for the head than for the nut. But it is quite a common practice to make the depth of the head equal to that of the nut. For the present we shall consider this to be correct, so that our remarks relating to the nut will also apply to the head of the bolt. We shall soon give a table in which the depth of the heads will be given.

386. Having established the distance between two parallel sides of a hexagon nut, our next step will be to find the distance across corners; that is, the distance between the edges $a\ g$ and $d\ j$, shown in Fig. 274. To do this we again call to our aid some of the principles in elementary geometry.

Let $a_4\ b_4\ c_4\ d_4\ e_4\ f_4$, in Fig. 277, represent the plan of the nut, and let $o_4$ be its center. Join the alternate vertices, as $f_4\ d_4$ and $b_4$, by straight lines, then will $f_4\ d_4\ b_4$ be an equilateral triangle. Also join the center $o_4$ and vertex $f_4$ by a straight line.

In geometry it is proved that a side of the equilateral triangle $f_4\ d_4\ b_4$ is to the line $o_4\ f_4$ as the square root of 3 is to 1. The square root of 3 is equal to 1.732, and therefore we may say that

1.732 is to 1 as $f_4\ b_4$ is to $f_4\ o_4$.

But $f_4\ o_4$ is equal to one-half the distance between the vertices $f_4$, $c_4$, and therefore, as soon as we know the length of $f_4\ o_4$, which is found by the foregoing proportions, we have only to multiply it by 2; the product will be the distance between the vertices $f_4$ and $c_4$; that is, the distance across corners of the nut; and to find this distance was our aim.

This rule for finding the distance across corners can be simplified, and will be best explained by taking the following example: Suppose the length of the line $f_4\ b_4$, that is, the distance between the parallel sides of a hexagon, is just 1 inch, it is required to find the distance from $f_4$ to $c_4$, that is, the distance across corners. Now, according to the proportions given before, we have,

1.732 : 1 : : 1 inch : $f_4\ o_4$;

hence, $\frac{1}{1.732} = .57736$ of an inch, which is the length of the line $f_4\ o_4$; and, according to what has been stated before, we have

$.57736 \times 2 = 1.15472$ inch,

which is the distance between the vertices $f_4$ and $c_4$, or the distance across corners.

In this example we see that the distance from $f_4$ to $c_4$ is equal to 1.15472 times the length of $f_4$ to $b_4$; and it can easily be proved that, in all hexagons, large or small, the distance across corners is equal to 1.15472 times the perpendicular distance between any two parallel sides. For all practical purposes the result will be near enough by using 1 155 instead of 1.15472.

387. From the foregoing we have the following rule:

Multiply the perpendicular distance between any two sides of a hexagon by 1.155; the product will be the distance across corners.

EXAMPLE. What are the dimensions of a hexagon nut for a bolt $\frac{3}{4}$ of an inch in diameter?

The depth of the nut is equal to the diameter of the bolt, hence, it must be $\frac{3}{4}$ of an inch. The distance between two parallel sides is equal to $\frac{3}{4} + \frac{3}{8} + \frac{1}{8} = 1\frac{1}{4} = 1.25$ inch. The distance across corners of the nut is equal to 1.25 inch $\times$ 1.155 = 1.44375 inch; and the distance between the two edges $b\ h$ and $c\ i$ (Fig. 274) is equal to $\frac{1.44375}{2} = .72187$ of an inch.

388. The foregoing rule is not only useful for finding the dimensions of a hexagon nut, but it is also applicable to the solutions of other practical problems. Thus, for example: What must be the diameter of a shaft whose ends are to be cut down to a hexagonal form, the distance across corners to be equal to the diameter of the shaft, and the distance between two parallel sides to be equal to 2 inches? $2 \times 1.155 = 2.31$ inches, which is the diameter of the shaft.

389. The upper face of hexagon nuts are generally chamfered, which will decrease the length of their lateral edges. The chamfer will cause the formation of curved edges on the top of the sides, as $b\ t\ c$ in Fig. 274 or $f_3\ t_5\ a_3$ in Fig. 276. The form of these curves may be arcs of circles or otherwise, depending on the kind of chamfer used. The curves may also be tangent to the upper surface $w\ w$ (Fig. 274), and again they may not touch the line $w\ w$, as this depends on the amount of chamfer. How the positions and forms of these curves can be found will be explained when we treat on the intersection of curved surfaces. At present it is sufficient to know that in hexagon nuts, no matter whether these curves are arcs of circles or otherwise, the curves will cut off the same amount from each lateral edge of the nut, and that the curves will extend from the upper extremity of one edge to the upper extremity of the next one. And again, since the majority of draftsmen represent these curves to be arcs of circles, and for the sake of convenience draw them tangent to the upper surface $w\ w$, the student may always do the same in simply representing a nut, without any fear of falling into any error.

390. From our remarks in the foregoing articles, we conclude that we can make the projection of the nut *A* in Fig. 274 without the aid of the plan of the same, such as is shown in Fig. 275, and is accomplished in the following manner:

Let it be required to find the projection similar to those in Fig. 247, of a nut suitable for a bolt $\frac{3}{4}$ inch in diameter.

In article 387 we see that the dimensions of such a nut must be as follows:

Depth $= \frac{3}{4}$ inch.

Distance across corners $= 1.44$ inch.

Distance between parallel sides $= 1.25$ in.

Distance between the lateral edges $= .72$ of an inch.

Draw the horizontal line $g\ j$; through a point $s$, on this line draw the center line $s\ u$ perpendicular to $g\ j$; from the point $s$ as a center, and with a radius equal to the depth of the nut, namely $\frac{3}{4}$ inch, draw an arc $b\ t\ c$, and draw the line $w\ w$ parallel to the line $g\ j$, and tangent (Art. 140) to the arc $b\ t\ c$. From the point $s$ as a center, and with a radius equal to half the distance across corners, namely $\frac{1.44}{2} = .72$ of an inch, describe two short arcs cutting the line $g\ j$ in the points $g$ and $j$; through these points draw the lines $a\ g$ and $d\ j$ perpendicular to the line $g\ j$. Again, from $s$ as a center, and with a radius equal to one-half the distance between the lateral edges, namely $\frac{.72}{2} = .36$ of an inch, describe two short arcs cutting the line in the points $h$ and $i$, and through these points draw the perpendiculars $b\ h$ and $c\ i$, cutting the arc $b\ t\ s$ in the points $b$ and $c$ respectively. Midway between the edges $a\ g$ and $b\ h$, and parallel to the same, draw a straight line (which must be erased after the nut has been drawn), and on this line find by trial a center $v$ from which the arc $a\ b$ is drawn tangent to $w\ w$, and cutting the line $b\ h$ in the point $b$; in a similar manner describe the arc $c\ d$; if accurately drawn, the horizontal line $a\ d$ will pass through all the upper extremities of the lateral edges $a\ g$, $b\ h$, $c\ i$ and $d\ j$. Lastly, from the point of tangency $t$ as a center, and with a radius equal to one-half the distance between the parallel sides, namely $\frac{1.25}{2} = .625$ of an inch, describe two short arcs cutting the upper face in the points $w$, $w$, join the points $a$ and $w$, also $d$ and $w$ by straight lines, which will complete the projection of the nut. In a similar manner, the projections, like those in Fig. 274, of all hexagon nuts, are found.

391. To find the projection, similar to those in Fig. 276, of a hexagon nut, suitable for a bolt $\frac{3}{4}$ inch in diameter. Draw the horizontal line $l_3\ h_3$; from the point $g_3$ as a center, and with a radius equal to one-half the distance between two parallel sides, namely $\frac{1.25}{2} = .625$ of an inch, describe the two short arcs cutting the line $l_3\ h_3$ in the points $l_3$ and $h_3$. Through the points $l_3$, $g_3$ and $h_3$ draw lines perpendicular to $l_3\ h_3$. On the line $l_3\ t_3$ lay off a point $t_3$ at a distance of $\frac{3}{4}$ of an inch from $l_3$. Through the point $t_3$ draw a line parallel to $l_3\ h_3$. On the lines perpendicular to $l_3\ h_3$ lay off the points $f_3$, $a_3$, and $b_3$. The distance between these points and the line $l_3\ h_3$ must be equal to the length $a\ g$ or $b\ h$, etc., in Fig. 274. Midway between the lines $f_3\ l_3$ and $a_3\ g_3$, and parallel to the same, draw a straight line, and on this line find by trial a point from which, as a center, an arc $f_3\ t_5\ a_3$ can be drawn tangent to the upper face of the nut and terminating in the points $f_3$ and $a_3$. In a similar manner describe the arc $a_3\ b_3$, and thus complete the projection of the nut.

It must be remarked here that when the curves $f_3\ a_3$ and $a_3\ b_3$ are drawn tangent to the upper surface, the lines $f_3\ l_3$ and $b_3\ h_3$ must also be extended upwards to the upper surface, but the line $a_3\ g_3$ must terminate at the point $a_3$. The reason for this will be better understood as we proceed.

392. When hexagon nuts are chamfered, as shown in Fig. 274, we must show, in the other view of the nut, such as is represented in Fig. 275, an inscribed circle, the circumference of which indicates the intersection of the chamfer and the upper surface of the nut. In fact, drawing the inscribed circle has quite an advantage, because, when the nuts are drawn to a small scale, the least inaccuracy in drawing the sides of the hexagon will show very much, but by inscribing the circle, small inaccuracies will be hidden and generally a good appearance obtained.

393. Projections made according to the foregoing instructions will show the correct dimensions of the nut; but since it takes too much time to compute these dimensions, the draftsman draws these nuts to dimensions only approximately true, and adopts the following method:

When a projection, like those in Fig. 274, of a nut is to be made, the distance across the corners, that is, from $a$ to $d$, is made equal to twice the diameter of the bolt, and the distance between $b$ and $c$ equal to the diameter of the bolt. The depth remains the same as before, namely, equal to the diameter of the bolt. In drawing the different lines in this projection, the same method is followed as previously described.

For finding the distance between $l_3$ and $h_3$, in Fig. 276, a temporary line, making an angle of 60 degrees with the line $g_3\ j_3$, is drawn through the point $g$ in Fig. 274; this is readily accomplished with the set square containing the angle of 60 degrees. Then, from the center $s$, the compasses are set suitable for describing an arc tangent to the temporary line, and with this radius, and from the center $g_3$, Fig. 276, short arcs are described, cutting the line $l_3\ h_3$ in the points $l_3$ and $h_3$. After this, the mode of procedure is the same as before.

The dimensions of nuts drawn in this manner will be somewhat large, but in small scale drawings the inaccuracy is scarcely perceptible.

DIRECTIONS.—In space marked Prob. 53, draw two views, like those shown in Figs. 274 and 276, of nuts suitable for $1\frac{1}{2}$, $1\frac{1}{4}$, 1, $\frac{3}{4}$ and $\frac{1}{2}$-inch bolts.

The projections of these nuts should be full size, and the centers of the nuts in each projection lie in one straight line, as shown.

The dimensions of these nuts must be the correct ones, which the student should compute by the rules given.

## Ohio Centennial Exposition.

We have received from G. A. Gray, Cincinnati, Ohio, Chairman of the Machinery Department of the Centennial Exposition of the Ohio Valley and Central States, the following copy of specifications, which will give some idea of the machinery required for driving. The specifications are followed by an explanatory sheet. The Exposition opens July 4, and closes Oct. 27.

SPECIFICATIONS.

Boilers, engines and shafting for machinery department, Centennial Exposition of the Ohio Valley and Central States, in 1888.

*Boilers.*—Six batteries of not less than

one hundred horse-power each, for driving engines in power hall. Two batteries of not less than two hundred and fifty horse-power each, for electric light.

*Engines.*—Four engines of about one hundred horse-power each, for driving shafting in power hall. Two engines of about two hundred horse-power each, and two engines of about one hundred horse-power each, for electric light plant in park building.

*Shafting.*—Four pieces $3\frac{15}{16}$ shafting about 12 feet long. 125 pieces $2\frac{15}{16}$ shafting, 16 feet long, with hangers and couplings, driving pulleys, etc., for power hall. 10 pieces $3\frac{15}{16}$ shafting about 18 feet long with couplings and hangers, driving pulleys, etc., for electric light plant.

Mr. Gray writes us as follows in regard to the Exposition:

You have probably heard that we are to have a great Centennial Exposition here in 1888.

In addition to the permanent buildings we are putting up a machinery hall over 1,300 feet long, 150 feet wide, and a main hall 600×400, all to be lighted with 400 arc electric lights, and 2,000 incandescent lights.

This, we think, will be the grandest exhibition of the industrial arts ever held in the West.

Enclosed find circular to engine and boiler builders. As you will see, we will have eight driving engines, aggregating 1,100 horse-power. We have so far received proposals for the greater part of them, under conditions named in circular.

## Designing Stationary Steam Engines.

BY W. H. BOOTH.

PISTONS.

Much American practice in the important detail of steam engine pistons is very far ahead of anything usual in England or Europe. I refer here more especially to the depth or length of the piston. It is no unusual thing in England to find the piston of a cylinder 42 inches diameter, as little as 10 inches long, and of this length the rings take up 4½ inches, so leaving only 5 inches clear bearing surfaces after subtracting the rounding of the body and junk ring edges. Seeing that the packing rings carry only their own weight, it is evident that a surface of 5 inches is insufficient to carry so large a piston, together with the weight of part of the piston rod. But apart from the insufficiency of the bearing surface, there remains the fact that a narrow bearing is less fitted to retain the lubricating material between the rubbing surfaces than when surfaces of greater contact are employed, and a long piston too is less liable to bind in the cylinder than a short one, and so works with greater freedom, quite apart from other considerations. To increase the bearing surface without proportionately increasing the weight of the piston, several methods may be followed. The piston may be cast a mere hollow shell with peripheral grooves for packing rings turned in it, or it may be cast of I section with a central disk into which is secured the piston rod and broad outer flanges, extending the bearing well beyond the middle web. The first method is that employed when the cylinder heads are plain, whilst the second is that usual in English locomotives, and requires the cylinder heads to be similarly formed in order to fit upon the piston faces with only the necessary clearances of about $\frac{3}{8}$ inch. It may be noted here that the practice of using narrow pistons has arisen from the great prevalence a few years back of vertical cylinder engines, and the failure of so many horizontal engines is almost wholly due to the lack of appreciation of the changes involved in moving an engine round from a vertical to a horizontal position. An engine builder once remarked to me that a horizontal engine was simply a vertical engine laid upon its side, and he would build either engine from the same detail drawings, thus proving that he was wholly ignorant of his art. It is easy to see that a narrow piston may be moved up and down vertically in a plumb upright cylinder and theoretically never touch the cylinder if only $\frac{1}{100}$th of an inch smaller in diameter than the cylinder. The packing rings alone bear upon the cylinder, and for bearing purposes no width of piston at all is needed beyond that required to withstand steam pressure, etc. But place such a design upon its side and the piston will very soon cut into the cylinder, and wear will be rapid. Of the two methods thus described, that of the hollow piston is best when such refinements as piston steam jacketing are adopted, but otherwise there is perhaps not much to choose between them, though, where possible and convenient to use flat heads, the shell type is best, and we should generally advise its use in preference to the double disked or single disked piston. A third method of increasing the bearing surface of a piston is to cast shoes or prolongations upon the lower portion only, so as to extend the supposed bearing. This is better than no extension at all, but is a needless complication, involving a special and non-uniform design of cylinder head to accommodate it. The prolongation should extend all round. The reason for this is that, although no pressure is exerted against the crown of the cylinder by the piston body, yet the narrowness of the face of the piston is very unfavorable to the retention of lubricant, and as there always is a difficulty in lubricating the upper side of a horizontal cylinder, it is important that means should be taken to hold up the oil or other material, so as to insure the upper side of the packing against ever working dry. That this will and does occur is proved by the fact that cylinders often wear most at the top. Piston depths must largely be a matter of experience. Some builders make their pistons of such a depth that portions of the cylinder are never exposed to steam, and this is by no means bad practice, though liable to lead to great cylinder lengths. As a guide, the following empirical rule may be employed:

Add twelve to the diameter of the cylinder in inches; then a fourth of the sum will be the length of piston to be employed. This does not include the packing rings, the breadth of which must be added to the length thus found, and the result is the total length or thickness of the piston from face to face or from edge to edge, if of I section.

Expressed as a general formula for those who prefer this shorter method of stating a rule, we have

$$W = \frac{D + 12}{4}$$

where $W$ is the piston length in inches, without including packing rings, and $D$ is the diameter of cylinder in inches. For the diameters as below, this rule gives the depths as shown:

$D = 4'' - 8'' - 16'' - 20'' - 24'' - 36'' - 48'' - 60''.$

$\frac{D+12}{4} = 4'' - 6'' - 7'' - 8'' - 9'' - 12'' - 15'' - 18''.$

For high piston speeds it is advisable that the piston length should be greater than when speed is low. The above lengths do not include width of packing rings, which must be added to the dimensions found, to give the total piston length, $W$ being actual weight-bearing surface.

Probably the greatest constructional error made in pistons is the common one of turning the body of the piston just a trifle smaller than the cylinder diameter. This practice is quite correct for vertical cylinders, but entirely wrong for horizontal engines, for if the piston body, or "block," is made ever so slightly smaller than the cylinder, it is clear that the point of contact between the two rubbing surfaces is theoretically but a line, and that no generous bearing surface is provided until the piston has ground itself down into the cylinder to the extent necessary to secure a peripheral contact of at least 120 degrees. Good practice demands that the piston be carefully turned to a diameter not less than the diameter of the cylinder—indeed, to an inappreciably greater diameter, so that actually the piston should not be able to enter the cylinder when it comes from the lathe. This done, the upper half of the piston block requires to be dressed away by the shaper or by the milling tool, the center upon which the piston revolves during the operation being a little eccentric to the piston center and of a radius about the 32d of an inch greater. The result will be then that the piston will fit exactly in the lower half of the cylinder, and be free in the upper portion, where the packing rings prevent steam leakage. Actually the packing rings are only required at the upper half of the cylinder, for the lower half is made tight by the accurate fitting of the piston block, and in the lower half should occur the joints of the packing rings, which, however, must not be in line, but break just equally on either side of the center line, about 15 or 20 degrees removed from it.

## Design and Construction of Machine Shops, Boiler Shops and Foundries.

BY W. H. HOFFMAN.

THIRD PAPER.

The design and general arrangement of iron foundries has been often discussed in the columns of the AMERICAN MACHINIST, and I shall therefore not attempt to give my ideas in regard to this department in detail. Dry sand work will probably be in demand as long as the present system of working metals in a foundry is in use, and therefore provision should be made in building a foundry to produce this class of castings as cheaply as possible. Pits must be built in some portion of the main floor, either of iron or brick, for the purpose of laying up loam work, and in many cases drying the same in place. The portion of the foundry set apart for loam moulding should be encased with water-tight walls, and the bottom of this compartment should also be laid with water-tight material.

If the foundry is to be a large one, say 50 feet wide and 200 feet long, we should arrange to have at one end of the building a space 50 feet by 70 feet for making all classes of loam and dry sand castings, and this whole space would be enclosed below the floor line, as described above. Within this space can be placed iron and brick curbs for special work, while the entire compartment can be filled in with moulding sand.

For a foundry of this size, there should be four core ovens, three of which would be rectangular in form, of the following dimensions. One 12 feet by 20 feet, one 8 feet by 15 feet, and one 6 feet by 9 feet. The fourth oven should be a circular one, 5½ feet in diameter, and 8 feet 6 inches high. The two largest ovens should be located at and in direct connection with the loam moulding department, and the small rectangular and the circular ovens should be placed at the other end of the foundry, which is set apart for small castings, snap moulding, etc. Assuming that we adopt the traverse crane system, we should prefer a wide and a narrow traverser side by side, instead of one wide and one extending the whole width of the building. We should place the wide crane on the side nearest the cupolas, and extend the tracks 150 feet from the loam moulding end of the foundry, while the narrow crane would have its tracks extended 105 feet from the same end of the building, or enough only to reach the cupola jib crane. The two large core ovens would have a railway track in each, connecting with the main track in the foundry, and each oven should have its own heating furnace. In the space not occupied by the two traverse cranes, we should place the most modern and convenient wall and jib cranes, arranged to swing under the wide traverse crane at several points in the length of the track.

The core ovens and cupolas should always set back clear of the main walls of the foundry, and should be located in separate compartments, with ample space around the cupolas, both on the ground and platform floors, these floors being composed of cast gratings. The writer believes in strong, high walls for a foundry, and does not believe in using timber and lumber in construction, except where absolutely necessary.

In constructing the roof, we should adopt the riveted iron plate truss, and thus carry one-half of the load on the cranes by a suspended truck hung from the roof trusses, the other half being carried on the walls of the building. At the loam moulding end of the traverse tracks there would be one central column placed under the central track, as at this point both cranes can be used in connection with each other, making a combined hoisting capacity of 22 tons, the wide crane being 14 tons, and the narrow one 8 tons capacity.

This foundry should have three cupolas, two of these being at or near the center of the building's length, and the third one should be placed conveniently near the end allotted to snap moulding and other small castings. The small cupola should be able to melt three tons, and the two large ones combined, 25 tons for an afternoon's work. The power for driving blowers, flask-shop machinery, traverse cranes, power jib cranes, rattler, drop, etc., should be derived from an independent steam plant, located in a building connected to the main foundry. The boiler should be large enough to heat the foundry in the cold season, the lower or discharging ends of steam coils being connected with a receiver and small air pump, to induce perfect circulation in all of the coils, and at the same time continuously free them from water.

The cleaning room should be directly connected with the main railway track in the foundry, and should be near the end in which the green sand work is done. This room should be provided with one good jib crane, and an endless overhead single track, with three traveling trolleys thereon.

The core making should be kept out of the main body of the foundry as much as possible; therefore a room of liberal size should be built in a central position, for the exclusive use of the core makers.

The pig iron lifts for the cupolas should all be hydraulic, and the pumps operating these should act as fire pumps also. The flask making should be done in a building isolated from all others, and this shop be furnished with the necessary plain wood-working machinery. The drop for breaking up old castings should always be operated by power, and there are many simple methods of doing this work.

The foreman of the foundry should have a room located near the center of the buildings, to be used as an office and testing room, for in this room there should be a standard testing machine. At each heat there should be a set of bars cast from each cupola, if the mixtures are different, and these bars should be broken by the foreman every morning after a cast. In this way a watch can be kept on the material, and if the quality is falling off, the makers can be notified, thus preventing future trouble and expense.

Although it is necessary to have quite a number of patterns in the foundry at all times, yet we think, as a general rule, there are more patterns stored, as it were, in the foundry, than there should be. There should be a system of removing a certain number of patterns every day to the fire-proof pattern lofts, for it will pay in the matter of repairs as well as safety.

As to the item of lighting, we believe in electricity, and the arc and incandescent systems can both be used to advantage.

We believe the above furnishes matter for the construction of an economical working foundry, built on the traverse crane system; but for a jib crane plant the arrangement would need some changes in detail, and a design by Mr. L. C. Jewett, published in the AMERICAN MACHINIST, Nov. 5th, is one of the best on the jib plan that has ever come to the notice of the writer. The plan is compact, and the general arrangement of cranes leaves a clean floor, while the track system is particularly well designed for the convenient handling of material and completed work.

The foundry business is, when well conducted, one of the best and most profitable in the engineering line, and any foundry worth building at all is worth building well. Speed, convenience, and durability, should be the chief aims in laying out a foundry plant, and if these ends are attained the property will coin money; on the other hand, there is no money, no comfort and no future in a "slip shod" foundry. In the latter class, the profits, if these are ever realized, are swallowed up in a never-ending line of repairs and reconstruction.

## Practical Details of Blacksmithing.

BY B. F. SPALDING.

In describing and giving details of the plans pursued and methods adopted which I have met with, for making certain things which I may single out as examples, I shall not assume to locate their position in progress, but set them at once on the plane of to-day. It may be that they will not be the very best that could have been devised, or that are now in practical operation. They are not offered with any such assertion; they are offered as experiences to teach each its appropriate lesson; to stimulate investigation in the young and to suggest ideas to anyone who is looking for them.

In casually looking over a lot of rivets one time, I came across one which, by some derangement of the machine, had acquired a shape similar to Fig. 1. I thought it was a curious freak, and laid it away on a little shelf in my desk and thought no more about it. I suppose it came to sight every little while when I tumbled over my things in search of some of my lost jewels, but I did not notice it particularly. It was perhaps a year afterwards when a job came into the shop to be made in quantities, which recalled my little deformed rivet to my mind. This was an eccentric shaft $1\frac{3}{8}''$ in diameter, 12" long, and with a throw of $1\frac{1}{4}''$

If I had had but one to make, I should have made it, as the saying goes, "on the anvil," by which is meant that I should have made it with the tools in general use in the blacksmith shop. I might have taken a bar of good round iron $2\frac{1}{4}''$ in diameter and "set down" at *A*, Fig. 2, with a "half round setting down tool" $2\frac{1}{4}''$ from the end, and drawn out that end to $1\frac{3}{8}''$ round and long enough to have a little to cut off to square up the end. I would then have cut off $2\frac{3}{4}''$ of the bar and set down on the opposite side at *B* to the proper depth, being very careful not to go too deep, and drawn out the other end. In setting down at *B* I should leave stock enough between *A* and *B* for the collar, and this I could straighten and square up with a sow block or heading tool, and work into the proper shape, and then line up the whole thing with the swaging tools, cut off both ends from the center of the collar, and, if the iron was good, and the coal was good, and the work was well done, and there were no cold shuts, I should have a fair piece of work. Some blacksmiths might use square iron instead of round, and if I was making one with my life at stake on its proving good, I would use square iron myself, blocking it out square all the way through, and working round corners at the shoulders until I got ready to finish it off.

These shafts could have been made in quantities on this principle by making special trip-hammer dies for the purpose, but all the stock in the piece would have to be worked over by this method, as no part of the finished piece, except the collar, would be of the original size from which it was made. The rivet suggested a better plan. This was to make the piece from $1\frac{3}{8}''$ round iron, which came as merchant iron from the mills already of the right size and shape, except in the middle, where the offset was to be and the collar formed. This reduced the amount of stock to be worked over to a piece of $1\frac{3}{8}''$ round, $1\frac{1}{4}''$ long, which had to be altered in shape to a piece $2\frac{1}{8}''$ round and $\frac{1}{2}''$ long in such a manner that the two ends of the shaft should project from it on either side in their proper places.

In order to perform the operation thus indicated a cast-iron die was made for the drop, in the top of which was a recess 5" deep, 3" wide, $3\frac{1}{2}''$ long at the bottom, and regularly tapering to the top, which was $8\frac{1}{2}''$ long. To weaken the die as little as possible, this hollow was semi-circular at the ends. A block was made to fit into it, of the same shape, but rising two inches above it a flat bottomed hole $2\frac{1}{8}''$ diameter $\frac{1}{2}''$ deep, was made in the center of the bottom of this block to form the collar, and as the centers of the eccentric were to be $\frac{5}{8}''$ apart, or each $\frac{5}{16}''$ from the center of the collar, a $1\frac{3}{8}''$ hole was drilled at that point 6" deep, to receive one end of the shaft, and a $\frac{1}{2}''$ hole was continued on through the block in which to put a pin for driving out the shaft in case it should stick. The illustrations, Figs. 3 and 4, are outlines of the block, and are bisected lengthwise.

Fig. 3 represents the block and die with the shaft as it stands before it is upset or thickened up and collared; and Fig. 4 the block and die with the shaft after it has been upset. In working these tools the die was set in the bed of the drop, and a plain, smooth top die fastened in the hammer. The heated shaft was then put in the lower die and the block lifted on to it with two $\frac{1}{2}''$ steel rods as porter bars, which were inserted in the holes *A A*. The blow was then struck, the flat die striking on the long upper surface of the block, and keeping it level as it drove it down, and the block bearing on the incline, as shown at the left-hand side of the figure, forced the shaft to offset as it thickened up, until it assumed the shape and position shown at Fig. 4.

The calculation to make was that the block should be sufficiently tapered on the grinding side, which is here represented as the left-hand side to permit the block to be put on while the shaft was still straight and to force it sidewise $\frac{5}{8}''$ as it was driven down to its place. The holes for the ends of the shaft being long, were made slightly tapering, so that as soon as the shaft was started out it became loose. The top die of the drop which struck on the block was flat and slightly greased, as the block had to move sidewise under great pressure. There was some common arrangement put in the bottom die, either a "do funny" or a "dingus" for starting out the shaft in case it should stick therein, and an opening was also made to let out the scales—these two things sometimes interfere with each other. A soft mellow heat in the right place made everything work nice and easy; too long a heat caused too much thickening up in the holes, and bothered about getting out. When they were cold they were straightened by striking them one blow in a die made to strike them a side blow the whole length. They were then centered and drilled on the ends and put into a special chuck which held them on one end up as far as the collar, while one side of the collar was squared, and one end was turned to size and squared to length as it ran on its center. Then the finished end was put into another special chuck and the same operations performed on the other end, and this completed the job, unless the collar was turned off on the outside, which would require another operation.

Before we made the finish straightening dies and had got the tools to working free all around, we sent a small lot into the machine shop that were somewhat crooked in getting them out of the upsetting dies, and as I stood looking at the man who had the job given him to finish them up, as he knocked and battered them about, and seeing him do this endeavored to devise some expeditious and cheap way of avoiding all that waste of energy, skill and expletives; he paused a moment to remark. "I like a lathe job where the man looks on and the lathe does the work, but this is one of the kind where the lathe looks on while the man does the work." But when the next lot came in he had a job which suited him better. "Not too much fat, but just about fat enough" was the language he employed to describe it.

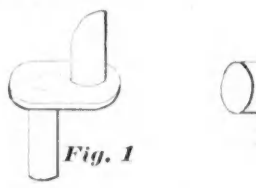


*Fig. 1*

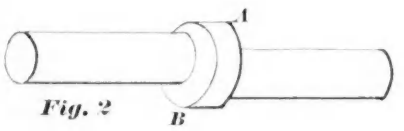



*Fig. 2*

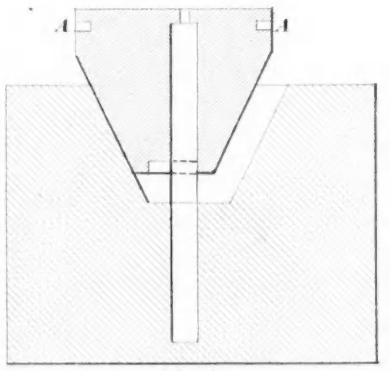



*Fig. 3*

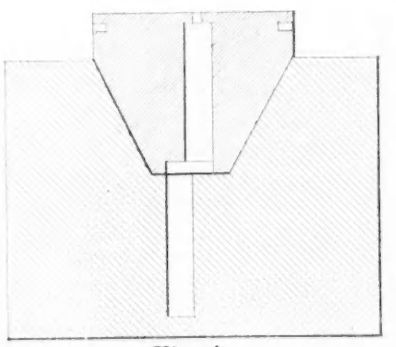


*Fig. 4*

## Turning Tapers.

One of our English exchanges, *The Mechanical World*, has an article on turning tapers which was awarded 15 shillings in a prize competition.

The writer states that it is a common practice in English machine shops to use a slide rest set to the required taper, and where, as frequently happens, the length of the cut exceeds the travel of the rest, the tool must be drawn out and the rest and tool readjusted. Then another method spoken of is by an adjustable "guide-bar" at the back, to use which the cross feed screw is removed, and the tool block attached to a slide working upon the guide-bar. Both these plans are condemned, and the plan of connecting the lead and cross-feed screws by gearing advocated as the only satisfactory and accurate method. In this country such a plan would be considered very cumbersome, and as to its accuracy, when the screws become worn it would be anything but accurate.

We do it much better in this country by the use of the "guide-bar," but it is arranged so as to be convenient and accurate, and it is not necessary to remove the cross-feed screw when using it.

A great deal depends upon how you go about a thing, as to whether it is successful or not, and this "guide-bar," which in this country we call the taper attachment, and which this English mechanic hopes will soon "be relegated to the shelves of some antiquarian museum," is one of the most successful and satisfactory devices ever introduced into machine shops, when properly constructed and understood.

Secretary Sinclair has sent out further circular inquiries to the members of the Master Mechanics' Association. The subjects are: "Prevention of Dangerous Escape of Live Coals and Sparks from Ash Pans;" "Advantage or Otherwise of Using Thick Tires;" "Tender Trucks;" "Purification or Softening of Water for Use in Boilers," and "Relative Proportions of Cylinders and Driving Wheels to Boilers." The subjects so far given out indicate that the next meeting of the Association will be an unusually interesting one.

The Etruria, of the Cunard line, has again broken the record by making the eastward trip from New York to Fastnet in six days and two hours.

## Condition and Prospects of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Lodge, Davis & Co. (Iron and Brass Working Machinery), Cincinnati, Ohio, write us:

Our business since last December has increased in volume to over three times that of any previous year. Machine tool users throughout the country have shown their appreciation of our endeavors to give them a complete lathe combining all the elements of stiffness, power and good workmanship. Last year we had only 19 and 21 inch swing of the new design, but we now have ready for the market 17, 19, 21, 24 and 27 inch swing, all of the same general design. The 24 and 27 inch are furnished with cabinets instead of legs, and are not only massive in appearance, but are so in operation.

We have added several planers, milling machines, lathes, drills, etc., to our plant during the past year. Have also enlarged our tool-room to three times its former size, and now keep steadily employed a force of seven fine mechanics as tool makers, to keep up our jigs and special tools for our new lathes, as fast as they come from the pattern makers.

The new line of drills, of which we have absolute control, has also been very favorably received, and a large force of men are kept constantly at work on these.

Have applied for a patent on a new quick return, which adds greatly to the value of the press. We are building these in sizes from 20 to 40 inch swing. They are very massive and powerful. Our shaper department is running full, as is also the department in which the brass workers' tools are erected. Our new cabinet fox monitor lathe, with power feed, will be ready for delivery January 1st. This tool is spoken of in the highest terms by all who have seen it, and we expect the sale of this machine to be very large the coming year.

We have greatly increased our force of workmen, and find the price of labor somewhat higher. We consider the condition of business most satisfactory, and, so far as we can see ahead, think we are going to have a very large business the coming year.

We are constantly adding to our force, and during the past year have not once been obliged to part with a single workman for lack of work.

The fact of our having recently asked for more space in your paper is, no doubt, sufficiently convincing to you that we appreciate its value as an advertising medium.

W. P. Duncan & Co. (Founders, Engineers and Machinists), Bellefonte, Penna., write us:

We have had an unusually busy year, our capacity having been taxed to its utmost. We have made no material enlargement beyond the addition of more tools in machine shop. At present we are somewhat slack of orders, but, judging from inquiries, the indications are that there will be business enough to keep all hands at work. Our "Vulcan" power hammer is gaining ground. We have more orders for this specialty than for a long time.

I. P. Richards (Standard Punches and Dies), Providence, R. I., writes us:

Business has been all that I have asked for. I have not pushed out for any new customers the past year, from the fact that I wanted to make some changes, which were very much needed. We have made entire new sets of tools and gauges, for the manufacture of punches in a more perfect manner than has ever been done before, and with the new year I shall bring out a new Standard, for punching all sizes of holes, from $\frac{1}{4}$ to $2\frac{1}{2}$ inch diameter.

These tools will be the best that I can offer, after twenty five years' experience in punching.

Wm. Lowe (Bridgeport Boiler Works), Bridgeport, Conn., writes us:

We are pleased to report that under our policy of using none but the best materials, and making everything in our line in the best and most careful manner, and asking a fair price for our products, we have been able to secure all the business that our facilities would do, forced to their utmost capacity, and have exceeded last year's business (which was a good one) over one-third. We have made more and larger Lowe boilers with all improvements this than any previous year, and in the Lowe feed water heater we have done even better than on the boilers, and as to other work, we have exceeded in variety any previous year, consisting of Lowe boilers and feed water heaters, the regular horizontal tubular boilers, of our well-known quality and proportions; vertical tubular boilers for both power and house heating, marine boilers,

cupola furnaces, rubber vulcanizing heaters from three feet to nine feet diameter, for rubber goods and covered wire; water-wheel penstocks and stand pipes, steam jacketed tanks and a variety of other tanks for various purposes: iron chutes for coal and metal, heating gas-conveying pipes, ore carts and self-dumping ore cars, and smoke pipes and smoke stacks. The wild and crazy competition of the times has held sway over prices, and the rush of everybody to get their work done at once, or to get somebody else's turn, has been the means of dividing up the work amongst the facilities. We might have obtained a larger portion had we increased our facilities, as others have done, to do more work in the same time, and helped to still further increase the facilities in our line, which were already too large for a steady and permanent business, at remunerative prices. It is our opinion that the time is close at hand when these increased facilities will lay idle, and but a small portion of the former ones be employed, and these at very unsatisfactory prices. As an indication of this, we refer to the varying prices and downward tendency of the materials we use. We can buy good reliable steel plates at about our own prices, and the prices of iron plates and bars are unprecedentedly low, all things considered, and as to tubes, in the spring the discount was but 42½ per cent. and slow delivery, but now our St. Louis agent writes us he can buy them at 62½ and 5 per cent., but the lowest price offered here is 58 per cent Comments are unnecessary, and would be of no avail to stop the crazy rush of this rushing period, wherein nobody recognizes that there is time enough and a to-morrow. At the present time we are fully employed on a miscellaneous list of orders, and have proposals out for a number of large and small jobs (one for 800 H. P. of Lowe boilers), more or less of which we shall get, and together with the orders from our many customers for their requirements in our line, we think we shall be fairly employed the ensuing year, but we think the rush is over for a time, and that the coming year will be a dull and unsatisfactory one generally.

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Sebastian, May & Co. (manufacturers of Foot and Power Lathes, Drill Presses, Supplies, etc.), Cincinnati, Ohio, write us:

We have to report that the amount of business for 1887 has far exceeded that of any preceding year. Part of this is due to our increased facilities and to the enlargement of our plant, and part to the increasing demand for machine tools.

During the past year we have erected a new four story brick factory, 50x65 feet, especially adapted to our business, and now occupy it with a complete line of first-class tools and appliances for the rapid and accurate manufacture of our specialties, so that we are now enabled to turn out a much larger amount of work and at less expense than ever before; but, with this increase in our facilities, we have not been able to catch up with our orders, and so making up a stock has been out of the question We have added a number of improvements to our tools, and have brought out some new designs during the past year, and also have some in contemplation, which we will introduce during the coming year.

Inquiries are more numerous than ever before, and as our tools become better known, the demand for them increases accordingly, and judging from the number of orders we are now receiving, and the reports we have from our agents, we feel justified in looking forward to a busy and prosperous year. Our sales to the numerous technical and manual training schools during the past year have been an important item, and we take pleasure in referring to it. It also shows the extent of improvement in educational methods. Prices of material and labor have advanced but slightly, and we are getting satisfactory prices for our tools.

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The G. A. Gray Company (Machine Tools), Cincinnati, Ohio, write us:

About eighteen months ago we removed into more comfortable quarters and doubled our capacity and plant. Since then we have purchased the adjoining property, and are making arrangements for further enlargements.

The price in machine tools has improved some, but not in proportion to improvement in quality required by purchasers.

We can see no reason for a falling off in the demand for first-class machine tools, as there seems to be an increased desire on the part of users of iron-working tools to get the very best to replace the flimsy ones of the last decade.

As we wrote you some years ago, it will be the "survival of the fittest."

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The Westcott Chuck Company, (Lathe and Drill Chucks), Oneida, N. Y., write us:

The expectations expressed in our letter of January, 1887, have been more than realized. Our orders for 1887 are greatly in excess of those of 1886, and our works have been running extra time the greater part of the year.

Our chucks are steadily growing in favor with machinists, and the demand for them is increasing with every month. The outlook for 1888 indicates a still larger and more extended business, which we shall meet by again adding new machinery, and thereby increasing our production.

A new drill chuck, "Oneida," that we have recently put upon the market immediately found a place for itself, and is selling as fast as we can manufacture it.

It is our aim to make and keep our chucks the best in the market, and to that end they must combine perfection of workmanship, strength, durability, accuracy, in all of which qualities the Westcott chucks stand unsurpassed.

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John Steptoe & Co. (Machinists' Tools), Cincinnati, Ohio, write us:

The year opened up with an overabundance of orders, but now, toward the close, as is usually the case, orders are somewhat light. Taken altogether our business for this year has shown a vast improvement over the former year—having had a steady and increasing demand for our crank and geared shapers, of which we make a specialty. We have gone to great trouble and expense in getting up special tools and appliances in order to increase our production, lessen the cost, besides improving the quality of our machines. In the past year we have designed entire new sets of patterns for a 30-inch iron planer with two heads; also a 60-inch iron planer, having two heads on the cross-rail, together with an extra side housing and head, besides having added several important features to our combined planer and shaper. In our line of other tools we have designed new patterns for a 26 inch extension gap-lathe; also 30, 36 and 42-inch engine lathes This completes our full line of lathes. Material has advanced somewhat, wages are about ten per cent. higher, while the prices on tools are much stiffer.

We have added several new machines, which, together with our special tools and templets, greatly facilitate our production. Have employed our full force the whole year, and judging from present indications the prospect for '88 is good.

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The Worcester Machine Screw Company (Standard Machine Screws), Worcester, Mass., write us:

We have had a good business all the year, and the present outlook for 1888 is very favorable. Prices have remained stationary through the year, with no tendency of any manufacturer to cut. The prices of labor and materials have not varied much during the year. We are enlarging our works, by building a new engine house and putting in a new Harris Corliss engine, of 70 horse-power, with an 80 horse boiler. We have also built an addition of 40 × 35 feet, two stories high, to be used as office and shipping rooms. We expect to occupy these new buildings about January 1st.

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The Acme Machinery Company (Bolt, Nut and Special Machinery), Cleveland, O., write us:

Our business has steadily grown from the time we commenced, about three years ago, and sales for the past year are nearly double in volume over the year of 1886.

We bought during the year an additional lot, 60 by 120, adjoining our present plant, erected a 40 by 40 two-story brick engine and boiler house, and put in a new automatic 60 horse power Cummer engine, with suitable new boiler.

Although labor and material are somewhat higher than a year ago, we have not advanced the prices of our goods, but added several valuable machine tools, some of our own make, designed especially for our own business, to cheapen the cost of production, thus enabling us to make up the difference.

With orders on our books to keep us busy for several months to come, and inquiries quite numerous the outlook for 1888 with us is very encouraging.

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S. A. Smith (Manufacturers' Agent), Chicago, Ill., writes us:

The demand for such tools as I handle has been very good—largely in excess of 1886—and the demand has kept up very late in the season. December has been very good, and the inquiries for tools for 1888 deliveries would indicate a good spring trade. If Congress will stop tinkering with the tariff, I think we are bound to have a good year's business.

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Watson & Stillman (Hydraulic Machinery, Engines, Brewers' Machinery, Polishing Machinery, etc.), New York, write us:

When we moved, last year, to our present location, increasing floor space nearly three times and our tools nearly one hundred per cent., we believed we would have plenty of tools and room. We have had to buy more tools and have more ordered, and are crowded nearly as much as before. Our old lines of tools and special tools have been of about equal importance. We now have more orders ahead than one year ago, with wages a little higher, and prices, where any change, a little lower. We think business would be good if Congress and presidential lectures on free trade could be avoided.

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Currier & Snyder (Upright Drilling Machines), Worcester, Mass., write us:

Our business the past year has been very satisfactory indeed; we have added a number of new tools, and also a number of new sizes to our list of drills. We have done about one-third more business this year than we did in 1886 We have just received an order from Germany, for one of our large size drills. This order we know should be credited to the AMERICAN MACHINIST. The outlook for 1888 is encouraging.

---

The Volker & Felthousen Manufacturing Company (Steam Pumps, etc.), Buffalo, N. Y., write us:

We are pleased to report the gratifying increase of 300% of the actual value of our sales for 1887 over those of the previous year. We have invested about $25,000 in new machinery and tools during the year. The improvements which we have made in duplex pumping machinery have been appreciated by the trade far in excess of our most sanguine expectations.

---

George B. Grant (Gear Wheels and Gear Cutting of every description), Boston, Mass., writes us:

I am able to report that my business has been good and increasing for the past year. It has nearly caught up with the large increase in my facilities for doing heavy gear cutting made the year before, and the prospect for the future warrants a further improvement and increase.

It requires heavy and costly tools to do heavy gear cutting cheaply and well, and I shall undertake to supply the demand.

---

The Hoppes Manufacturing Company (Feed-Water Heaters and Purifiers), Springfield, Ohio, write us:

We are as busy as can be, running ten hours per day and increasing our force. The orders received for the past two weeks will aggregate about 2,500 horse-power capacity.

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The Hartford Steam Boiler Inspection and Insurance Company, Hartford, Conn., write us:

The business of this company for the year 1887 has been by far the largest in its history. The company has now reached its majority, it being twenty-one years since it was incorporated, and there has been a steady growth in its business from the beginning. The outlook for 1888 is very encouraging. Manufacturers are becoming more and more desirous of dividing the responsibility of the care of their boilers with a corporation that devotes its entire time and effort to the question of safety and economy as relating to steam boilers.

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The Ferracute Machine Company (Presses, Dies and other Sheet Metal Tools), Bridgeton, New Jersey, write us:

Our past year's business has been about the same as that of 1886, but the amount of sales has been a little larger. Trade during the early part of the year was very brisk, but slackened up considerably after August 1st. It is now reviving somewhat, and there seems to be a fair prospect for trade next year. We have not added to our buildings during the year, but are about to do so, and the Pennsylvania R. R. Co. is running a siding into our works. We shall erect a yard crane, also another large crane in our erecting department, so that we can handle 10 tons with either of them. This will aid us greatly in our shipping of heavy goods and enable us to handle much heavier machines than heretofore We are building some special heavy machinery for our own use, which will cheapen the production of our presses, and we are also improving the workmanship on these tools by the use of jigs, templets and other special tools. We have had no labor troubles in our works during the year. Our wages are about the same as a year ago or a little higher, and we believe we are paying about the same for materials as in 1886. Our working force is about 80 hands, and we have not stopped during the year nor run on short time, except for three or four weeks on the eight-hour system. We have several thousand dollars' worth of orders now ahead and prospects of plenty more to come. Our opinion is that next year will be a good one for our class of business. Prices as a general thing are somewhat low, and consequently profits are small. This we think is a general complaint among manufacturers, and one that can be remedied only by introducing more special devices in cheapening production. We have just issued several new illustrated lists describing our tools in full. The new line of punching presses we mentioned last year have proved very popular, and we are selling them rapidly in all parts of the United States, Canada, etc.

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The Shipman Engine Company, Boston, Mass., write us:

The business outlook is most promising. Orders greatly increased over last year. Expect to double our sales next year.

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The Hendey Machine Co. (Machinists' Tools), Torrington, Conn., write us:

Our business for the past year has been good. We have been pushed to our utmost capacity through the entire year and are still very busy. We have added very largely to our machinery and have our factory about as full as we can work conveniently. Have also added an incandescent light plant, which gives us a very satisfactory light.

To our list of manufacturers we have added engine lathes 14 inch and 18 inch, and are now at work on a 22 inch, which we will soon have on the market. We have made little or no change in prices the past year, and hardly anticipate any change at present. In regard to the future we can say but little. We hope, and have reason to believe, that our trade will be good.

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The Hall Steam Pump Company, New York, write us:

We can state that our business has largely increased over the amount of trade obtained by us last year. It became necessary a few months ago to increase our manufacturing facilities. Every tool has been fully engaged. We anticipate the necessity of very materially enlarging our capacity this year. We close up the last month of this year with more orders in numbers and value than any one month in our experience.

We feel that your valuable paper has been of aid in bringing about this most satisfactory state of affairs.

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The Curtis Regulator Company (Steam and Water Pressure Regulators, Steam Traps, etc.), Boston, Mass., write us:

In regard to our business of manufacturing and selling engineering specialties, we have to say that we have made an increase in our sales over last year of about forty per cent. in amount. We have more than doubled our capacity for manufacturing since last year. We have large contracts with the Boston Heating Co. for regulators, converters and steam traps, to handle their 400lb. pressure of hot water in process of fulfillment, and our new specialties of frost proof steam trap and automatic pipe coupling, are meeting a large and ready sale, some railroads being entirely fitted with them and others having them on trial. We have just completed a new brass foundry, 115x30 feet, part of it two stories high. We expect even better things next year.

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W. P. Davis (Upright Drills, Slotting Machines, etc.), North Bloomfield, N. Y., writes us:

Our business for 1887 is larger than for any previous year. We have run full time, and, by special machines for doing our own work, we turn out more and better work. As we make, practically, a specialty on one style of 20 inch drill and one size of key-seating machine, we are able to turn them out much lower in price and still maintain a standard of excellence that cannot be done where a large variety of work is made.

We have in the past year covered our entire plant with iron roofing; have enlarged our works by building a foundry and blacksmith shops; have added a bath room for men, and have put in a new "string system" of electric fire alarm. We have also built a tower on main upright, which holds a large tank of water which is carried through the works in pipes, provided with suitable hydrants in different parts, with hose attached, so, in case of a fire in the daytime, we can have a stream of water playing on any point in or around the shops in one minute. The tank is supplied with a steam jet pump. We have also made several minor improvements in our office in way of filing papers, letters, etc., and also in manner of keeping our books for our particular line of business.

While sales have not been as good for past four months as during the six months previous, we think we can see a steady increase of business and a very healthy condition of same. One very favorable sign is, when business dropped off a few years ago, we

lost much of our Western trade, especially in the far West, while now we begin to get our trade from that locality. Our trade in California was the last to drop off and the last to come back, but we now begin to get orders from there again.

We think there is every reason to expect a good business year for 1888, notwithstanding the danger predicted by an overflowing treasury. Our experience has always been, a shortage is more to be feared than a surplus.

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The Sterling Emery Wheel Company (Patent Solid Emery and Corundum Wheels, Emery Machinery and Diamond Tools), West Sterling, Mass., write us:

Our trade has steadily increased for the past six months, and it has also been excellent this month. We have doubled our capacity at the works, and we are to-day driven with orders, and anticipate again enlarging our factory within the next six or eight months.

We have recently opened a New York office, so as to properly attend to the local trade, and at the same time gain a point of shipment from that city, to supply our Western trade more promptly than we are able to do from the factory.

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The Billings & Spencer Co. (Drop Forgings and Drop Forged Tools), Hartford, Conn., write us.

It is gratifying to us to report that our business surpasses that of the year 1886. We have been crowded to our full capacity, to keep pace with the demand for our goods, especially in our drop forging department. We have increased our plant during the year, and contemplate a further increase at once. Have put in the Waterhouse electric light, with a view of running overtime. The outlook for the year to come is favorable for a still larger business.

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J. A. Fay & Co. (Wood-working Machinery), Cincinnati, Ohio, write us:

Our business for the year 1887 has been very satisfactory in many respects. We have shipped 25 per cent. more than we did in 1886. We have added a large number to our force, and they have been at work full time throughout the entire year. We have made an addition to our buildings, and have purchased thirty new iron-working machines. These additions to our equipment have enabled us to supply the demand for our tools within a reasonable time. Our trade has been well distributed, coming from all parts of the United States, and from the principal centers in foreign countries where wood-working machinery is used. We have added a number of important improved tools to our already large list of machines during the year. There has been a greater advance in the price of labor and raw material than in the finished product. To overcome this, we have been making our machines in large quantities with improved tools and equipment, endeavoring to meet this discrepancy by reducing the cost in this manner. We still have a large number of unfilled orders on our books, and the prospect for additional business during the coming year is fair, although we do not think there can be much advance in finished goods.

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The Energy Manufacturing Company (Patent Portable Rope Hoisting Machines, Hatchway Hoist, Friction-Driven Center Grinder, Drill Guide and Steady Rest, Water-pressure Air Pumps, etc.), Philadelphia, Pa., write us:

On Nov. 17th, 1886, we began, without any patterns or even work ahead, to perfect and manufacture patented machinery and tools, expecting by the beginning of 1888 to be in shape to put our goods on the market, and not before. When a few of the articles were made, we desired to know with what favor they would meet, and to that end advertised in your paper and a few others, hoping to receive some little notice. Our greatest hopes were exceeded. Hardly had your paper been issued before numerous inquiries came from all quarters, and our small stock was gone, and we realized that we had advertised a little too soon. Since then we have been hard pushed to keep up with orders, and frequently have fallen behind, and in the effort to fill orders were obliged to suspend work on several of our new specialties. Wherever possible, we are improving on our work and goods. We will soon place six more sizes of our hoists on the market, and also during the year a number of new tools. We have shipped our goods in all directions, quite a number going to Canada. In many instances we shipped subject to trial, and the universal result has been that the articles were satisfactory and not one returned.

The prospects for the coming year are that we will do a large business, and to meet the demand are increasing our facilities, and will likely be obliged to find larger shop room before many months. Expect to fill all orders promptly, and feel we will receive our share.

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The National Pipe-Bending Company (The National Feed-Water Heater, Iron, Brass and Copper Pipe bent in Coils, Angles, etc.), New Haven, Conn., write us:

We can report a considerable increase in the business during the year; the figures at this time showing an increase of forty per cent. on gross sales. This increase in our business during the year has been larger since the first of June, and the summer months were particularly active for business. Our business for the months of July and August was more than twice as large as in previous years. We have a large number of orders on hand for heaters, coils, etc., which will keep us busy until February. The outlook for 1888 might be considered very favorable, except for the large advance in copper, which adds considerable to the cost of our goods. We have, during the year, built an extension to our shop, and put in a new boiler and considerable machinery, and we are continually adding machinery as is necessary for our business.

The year 1887 has been the best year we have had so far, and we hope to report a large increase in sales in 1888.

Our new catalogue, recently issued, giving a list of over 1,000 users of the National Feed Water Heater, will show that this very valuable heater is in use in all the States of the Union.

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The Newburgh Steam Boiler Works, Newburgh, N. Y., write us:

The year 1887 has been the busiest with us since we began business, nearly eighteen years ago. Work has been done on a close margin, but the volume of business done was much larger than ever before. We are constantly improving our shop and tools, and will always be up with the improvements of the age, in our line of manufactures.

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Wm. T. Bate & Son (Iron Founders, Boiler Makers and Machinists), Conshohocken, Pa., write us:

Our business has been increasing steadily for some years, the past year being a busy one. We have added to our plant during the year, and purpose adding more machinery early in the coming year. We are sorry to say the prices do not appear to improve very materially. We find, however, customers who are willing to pay for first-class work are more numerous, and the prospects for business next year are very favorable. We have made some changes and improvements in the construction of our steam generator, and feel assured the "Bate Patent Boiler," equal to any manufactured, is giving entire satisfaction.

We are also having an increased demand for our patent gas stop valve, which you kindly illustrated not long since in your valued paper.

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The Betts Machine Company (Machine Tools and Implements for Standard Measurements), Wilmington, Del., write us:

We have been very busy all the year, a considerable portion of the time running night and day, and in some departments have had a larger yield than ever before in our history. But in spite of this activity, the year's business has not been entirely satisfactory. Prices have been low, especially the first six months of the year, and wages and material, particularly fuel, have advanced. We have added considerably in the way of new machinery to our plant, and have greater capacity now than ever before. As to the future, it is hard to say—we have a good many orders on our books, but must confess to a falling off in inquiries in the past few weeks, notably since the meeting of Congress and the issue of the President's message. These two events, with their free trade tendencies, have a baneful effect on our trade; not that they have so much direct influence, but they produce a feeling of uneasiness in the minds of our customers. So that until we know to what extent these disturbing elements will affect business, we can hardly predict what the coming year will bring forth.

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D. Saunders' Sons (Pipe Cutting and Threading Machines and Steam and Gas Fitters' Tools), Yonkers, N. Y., write us:

Our business generally has been very satisfactory during the past year, showing a decided increase over 1886. With our new specialties, which we shall put on the market soon, the prospects are that we shall further increase our business during the year 1888.

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G. S. Woolman (Mathematical, Optical and Philosophical Instruments), New York, writes us:

Trade in my line, for the past year, has been very steady. There has been no special rush, but the demand for drawing instruments and materials has been constant. My goods being used by all designers of new machinery and by civil engineers in railroad work, can, I think, be taken as a barometer of mechanical trades in general. I look forward to '88 with expectations of a good, steady, wholesome trade.

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The E. Horton & Son Company (Lathe Chucks), Windsor Locks, Conn., write us:

We will say that our business, for the past year, has been very good indeed. Our regular business has increased, and been better than for several years; besides this, we have filled a good many larger orders, during the year, than we ever did before during the period of thirty-five years that we have been making chucks. We have added to our list a full line of improved independent chucks, besides many other styles of universal; and we carry in stock a greater variety of universal, independent and combination chucks than any manufacturer in this line that we know of. We are now engaged in putting in new tools and machinery and enlarging our works, so as to be able to increase our product one-third, at least, by the first of the year 1888.

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*Several letters stand over to appear in our next issue.*

## LETTERS FROM PRACTICAL MEN.

### Rod Brasses.

*Editor American Machinist:*

With this I send drawing of rod brass, with pattern and core-box for same. It is intended to cast the diagonal chamber with dovetail to same to keep babbitt in place without any chipping.

Each figure explains itself. Fig. 1 represents the brass; Fig. 2 the pattern; Fig. 3 the core-box, showing top and end views of each. The block *A* is first worked to

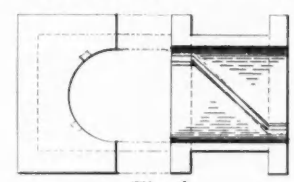

*Fig. 1.*

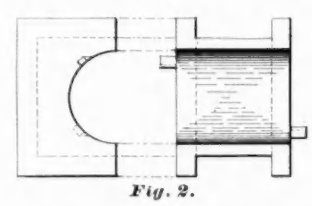

*Fig. 2.*

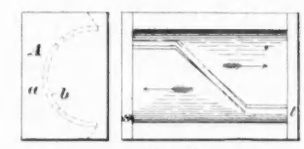


*Fig. 3.*

curve *a*, and cut to the length of pattern from outside to outside of core prints, then part *b* is worked to fit curve *a*, also to shape of bearing part of pattern. It is ready now to cut to the shape of chamber; end stops *s* and *t* keep it in place. When core is rammed up it is set free by moving the slides in directions of arrows.

W. Newton.

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### Calipers, Domes and Mud Drums.

*Editor American Machinist:*

I see in your issue of December 24th an article from Joseph A. Rothwell on Calipers and Their Uses, and he seems to dwell at some length on the method of adjustment, and that calipers, like everything else, if they are not right, cannot be used to good advantage. This is all very true, but he fails to tell us what constitutes a good pair of calipers. The kind that some of the machinists of the present day use are generally home-made, made of two thin pieces of steel, riveted together at one end, and a big washer on each side, and the legs bent to suit the taste of the maker. Now, with calipers made in that way, with the points nicely rounded up, as Mr. Rothwell says they ought to be, how long will they remain in that condition, when every machinist knows that to set such calipers he has to pull them open with both hands to somewhere near the size he wants, and if he has got them too wide, has to knock them against something to close them, then, if too close, he has to knock them against something hard to open them again, and repeat the operation until he has got them where he thinks they ought to be, regardless of how long it takes him to do it? I well remember, when an apprentice, the boss asking me to get him a pair of calipers, as he wanted to get the size of a shaft. I brought him a pair made in the above way, and he had to do as other men were in the habit of doing, keep knocking them first one way, then another, until his patience became exhausted. Then he threw them across the shop, sending a few cuss words after them, saying at the same time that such calipers were only intended for lazy people.

Now I think the best kind of inside calipers can be made from a pair of common dividers, that can be got at any hardware store. Heat the points in the fire, and turn them outward with a pair of round-nose pliers; then dress down to the proper length, and shape and harden. With such calipers, no knocking has to be done in order to adjust them. Simply loosen the thumb-screw, set them to about what you want, then set to the exact thing, with the thumb nut on the side, and they generally stay where you set them. For outside work the common store calipers, with the same method of adjustment, we have always found good enough for us.

In my article of a few weeks ago, on boiler feeding and boiler compounds, I find that I have stirred up a hornet's nest. I see that two of your readers have taken me to task about it. Well, that is all right. We like to have the opinion of everyone that takes interest in such things. Mr. J. A. Beaton says that the steam drum and its twin brother, the mud drum, should go. I think they are here to stay. It it a good thing we don't all think alike. What would our locomotives do without a steam dome? Every engineer knows that dry steam is a very desirable thing to have; this cannot be had if the steam outlet is near the water surface in the boiler, as every pulsation of the engine has a tendency to raise the water and carry it over with the steam. The result is that the engineer has got wet steam, and has to run with his cylinder cocks partially open to get rid of it.

While in a mill a few days ago I noticed that the safety-valve was connected to the shell of the boiler. I made the remark to the proprietor: "Are you not troubled with wet steam?" His reply was: "You bet I am. What will it cost me to put a dome on that boiler?" In the case of a boiler for heating purposes only, where great pressure is not needed, a dome could perhaps be dispensed with.

In regard to a mud drum, Mr. Beaton says that feed water should never enter a mud drum; that the feed can just as well pass outside of the boiler walls, and be called a trap or heater. True, it would be a trap. I think the fewer traps you have around a steam boiler the better.

Secondly, he says if there is any loose scale looking for a chance to get down into the mud drum it cannot get there, on account of a counter current of water coming up the neck or connection. He seems to forget that the hole in the neck is usually from six to seven inches in diameter, and any water coming from the pump would cut a small figure, as far as that is concerned.

He speaks of a case where he found a bushel of scale in the boiler, and not an ounce in the mud drum. If a boiler is properly set, it should be, say for a boiler 14 feet long, 1½ inches lower on the back end; and as every mechanic knows that mud is heavier than water, it will naturally gravitate to the back end, and finally settle in the mud drum; the proper place for it.

Benj. F. Hetherington.

Indianapolis, Ind.

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### The Trouble with a House Boiler.

*Editor American Machinist:*

If A. M., who asks Question 503, for the trouble with his house boiler, will look, I

think he will find that the circulating pipe is either choked with scale deposit or the plumber has made a solid joint between lead and iron pipe. There is, therefore, no circulation, steam forms and is forced back into the boiler, the condensation causing the rattling referred to. The choking of this pipe is a common occurrence when there is lime in the water.

READER.

### Something About Steel.

*Editor American Machinist:*

My long silence on the steel question is not because I have nothing to say. I am full and overflowing with alleged facts from practical men. I have found one who says: "Let me do the hardening, and I don't care who draws the temper." Another who, holding in one hand a piece drawn to a light straw, and in the other a piece drawn to a deep blue, says: "I can file this straw-color piece, but can't scratch the other; that is the difference in steel." I have found men who have learned that steel has a tendency on heating and cooling—hardening—to relieve itself to a slight extent from the compressed condition in cross section and the strained, stretched condition longitudinally, which have resulted from rolling or hammering in the regular line of manufacture. That is, it becomes larger and shorter; "it tries to get back from the condition of tension in which working had placed it." If the round piece from which, if a tap or reamer should be made and hardened, we might be almost certain longitudinal shrinkage would take place, should be upset with little or no transverse working to be twice the diameter of the bar, these men believe the shrinkage would be in the other direction. They are not scientific. But in their practical way they think the same thing in kind, only different in degree, takes place in steel as in softer materials.

I have found men who have dropped the belief that an old file is the ideal representative of best steel and best hardening, and have learned that a piece of really good cast-steel, hardened at just the refining heat, will beat all ordinary old files "out of sight." I have found men who have learned exactly the color and peculiar fineness of grain which indicate that steel was hardened at the right heat, and without anything for reference, can tell at a glance whether the heat at which any hardening piece, in which by breaking a fracture is visible, was right. I have found men who have thrown overboard the threadbare terms, "dark-red," "cherry-red," "bright-red," etc., etc., in describing the right heat at which to harden, and, instead, advise carefully hardening at the lowest possible heat at which hardening will take place, this heat being arrived at by first learning what heat will not harden, and then raising the heat a little at successive attempts until the right point is reached; then, when an experimental piece is hardened, breaking it, to let the grain, and the force required to break the piece, verify the judgment, after which, the color being noted, no matter whether it is a red which will show no yellow in the dark, or a red showing much yellow by a strong light, it is to be rigidly followed. These men have learned that different tempers of steel require different heat, each having its own peculiar heat, and further, they have learned that a heat which would be ruinous in small pieces would be not only admissible, but necessary, in hardening large pieces of steel of same temper, and so have concluded that instruction through arbitrary color rules for heating are as meaningless as for tempering. I have found men who have been growing gray for years since they learned that the only sure way out of the dire effects of overheating for hardening was to not harden at that heat, but to let the overheated piece cool off and heat it again, and these men let this belief spread out to compass the fact that homogeneity of molecular condition is one of the most important factors of safety in hardening, and so they anneal and re-anneal pieces in which the risks of hardening are great.

I have found men who learned, half a century ago, and have been thereby guided in their practice all these years, the facts that to have steel come out of the hardening process straight, involved proper working and annealing, proper heating, intelligent cooling, etc., and that during the temper drawing hardened steel may be bent or straightened, and also that after cooling sufficiently to insure full hardness, pieces in which the temper is not to be drawn, may, by removing from the cooling bath, while still retaining considerable heat—be straightened or bent as readily as though the temper was to be drawn, and the straightening or bending were to take place during the process.

I have found men who have read up on steel matters, and who, from the books, know that re-brightening and re-drawing the temper to the same color any number of times don't in any sense change the degree of hardness. And still some of these men believe that blazing the oil off from a spring twice or three times in tempering insures a safe spring, when blazing off once would almost equally insure that the spring would break. "A sort of guess-work," does somebody say? Well then, some of these same obstinate "hard heads" believe that continued cutting on a chilled roll, although at no time a tool is heated above what could be borne by the hand, will draw the temper of the tool sufficiently to demand re hardening. I have been told by a man whose practice in turning chilled rolls has not been exceeded by any other man in this country, that, "Say what anybody likes about it, it is a fact, he knows, that the temper in a tool is drawn by working on chilled iron."

I have known men who believed that steel could be hardened thoroughly hard without lessening its specific gravity, and that much of the apparent change furnishing the rule was due to purely mechanical—not chemical—causes. These men believe that there is a resisting force exerted by the outer and more quickly cooling parts of a mass of steel, which has much to do with holding and preventing the inner portions from getting back to normal size, and that a piece of coarse grained steel of such size as will harden clear through, if hardened at just the refining heat, may have its size diminished by hardening—its specific gravity increased. I wish some experimenter would prove the falsity of this, if it is false.

Of course, these beliefs of purely practical men have to give way to contradicting facts as developed by scientific research. But, there is so much depending upon following the beaten track, which has "panned out" well in the practice of successful men in the treatment of steel, as to raise the question whether they should not be at least permitted to have a voice in determining whether some of the new doctrines are based upon fact, or mere speculation.

S. W. GOODYEAR.

### Screw-Cutting and Boring Tools.

*Editor American Machinist:*

For some time we have made use of improved forms of boring and inside threading tools, and of a device for holding the same, which have made their use possible, and have found them so handy and satisfactory in every way that I can recommend them to users of such tools.

The tool-holder is shown in Figs. 1 and 2, Fig. 1 being a front elevation, and Fig. 2 an end elevation, which quite clearly illustrate the construction. The holder is bolted directly on top of the tool block, in any ordinary engine lathe having either a swing rest or other means of elevating the whole block bodily, by the one bolt shown, which has its head made large enough to fit in the tool post slot.

The holder is planed on its lower surface to obtain a firm bearing, and any required alignment of the tool is obtained by swinging the whole holder on the top of tool block. The holder complete, omitting the holding-down bolt, nut, and washer, consists of but four pieces, the body being a steel casting, having a V shaped groove planed for the reception of the tools, one of which is shown in place. The piece immediately over the tool is simply a piece of ordinary lathe tool steel, and is left as it comes in the bar, it being only to receive the ends of set screws, of which there are two, they being squared for the regular tool post wrench; the part of holder shown between the screws is simply a thin web to tie the upper part together.

Our holders hold from 1″ down to ⅜″ diameters of round steel, and we have never known a tool to slip in them. I have taken quite a cut with the screws only tightened with my fingers. We use the 1″ tool on every hole we can get it into, and this in a 16″ lathe.

These tools possess advantages over the too common inside tool, first, in having a cutting edge in the position to cut, and that does cut, instead of gumming off the metal, and second, in being easily kept in their original form. The forging is much easier than it appears to be; it is accomplished in the case of a 1″ bar having a square cut end by using a 1¼″ or 1½″ hollow for the lower swage, and a ⅜″ round for the top one, the end of the round bar being laid in the lower swage, and the upper one held at an angle with the bar; a few blows of the sledge does the forging; a few minutes on the emery wheel shapes the tool. The lip can be driven around the shank when reforging, and of course the shank being round, it can be rolled in the holder to bring the edge to the desired point. Top, side and end views of the cutting end of tool are shown.

For inside threading with V or U. S. S. thread in large holes we use the tool shown in Fig. 3. The cutters are made interchangeable on the shank, and are screwed on like a nut, the screw in our case being ⅜″

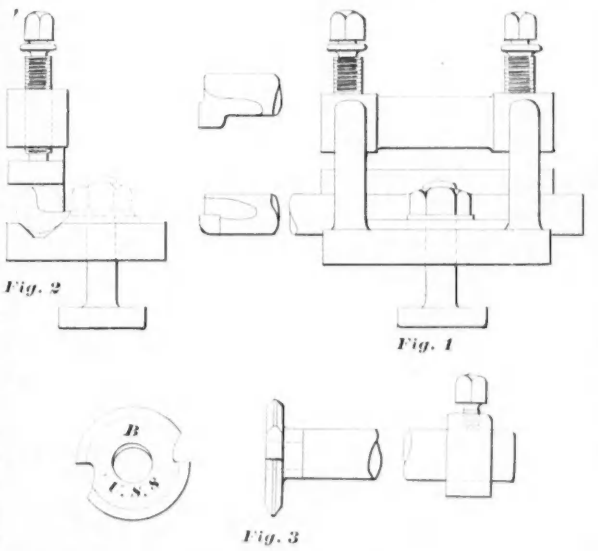


Fig. 2 Fig. 1 Fig. 3

SCREW-CUTTING AND BORING TOOLS.

diameter. Our cutters are turned up true and round, about 1½″ diameter, and are cut out in two places, as shown; then, after tempering, the angles are ground to the correct degree, and the flat top left the required width for pitch of thread, which is marked on each cutter. To sharpen it is only necessary to grind on the face, as in Brown & Sharpe's patent cutters.

In cutting threads the thread is roughed out with one lip of cutter, and finished with the opposite sharp edge, the cutter being unclamped in holder to do so. In turning it over, its proper endwise position in relation to thread already cut is secured by fastening the collar shown on cutter shank to it, and in contact with the end of tool holder before unclamping, and clamping again with it in contact. An accurate and easy way to set the thread tool may be found in lining its shank by the lathe ways when clamping the holder in position. The form of cutter, as we have so far made it, has no lead to agree with pitch of thread being cut, but there is no reason why lead may not be given to it by turning the cutter itself as a single thread of a double-threaded screw, except that in such case it would be difficult to correct the cutting angle after tempering.

CHAS. S. BEACH.

Bennington, Vt.

### Sketch of the Life of H. R. Garvin.

On Dec. 21, 1887, Mr. H. R. Garvin died, in the fifty-sixth year of his age. His life is another illustration of what energetic and industrious young men can accomplish. Mr. Garvin was born in Shapleigh, Maine; and his early years were spent on a farm. In 1844 he began to learn the machinist trade, and through his energy and attention to business soon worked himself into the front ranks. At one time he was a contractor in the Colt's Armory, Hartford, Conn., and some time after he was a contractor in the Star Armory, Yonkers, N. Y. In starting business he met with reverses and obstacles, which, through his courage and energy, he overcame. About ten years ago he formed a partnership and commenced business, under the name of E. E. Garvin & Co., on one floor in the building now occupied by the firm at 139-143 Centre street, New York city. Their business was then, as at present, the manufacture of machinery and machinists' tools. Through Mr. Garvin's experience in the use and building of this class of machinery and close attention to business, success was attained, and from time to time the business had to be enlarged to its present large capacity of building the class of machinery named. The business will be continued as formerly, his sons succeeding to his interest in the firm.

After all that has been said about opening up new fields of trade, the exports of this country to Great Britain are now, just as they were 25 years ago, more than 50 per cent. of the total.

The action of the Pennsylvania Railroad Company in receiving deposits from men in its employ, paying them a better interest than they can get in savings banks, is a commendable one, and will no doubt result in the saving of many dollars by the men. At the same time it is likely to make the men more contented, and hence is probably a wise move on the part of the railroad management. But this last consideration should not be permitted to weigh in the least to the discredit of the company. Men employed by that company now have an opportunity to put away such sums as they can save where it is as safe as anything in the world can be expected to be, and at the same time draw four per cent. interest on it.

But all railroad companies are not in the condition of the Pennsylvania, and if the plan of making savings banks of themselves were generally followed, there would be quite as much need of State supervision as there is now in the instance of regularly chartered banks.

The growing demand for steam of higher pressure for use in steam engines is working in the direction of permitting the use of thicker fire plates in steam boilers. It is a direct move backwards. Experience has shown a hundred times that thick fire plates were a delusion, at the best giving a feeling of security without basis. If higher steam pressure is desirable, as it no doubt is, the construction of boilers should be so changed as not to require thick fire plates.

Not so very long ago, steel rails, it was agreed, could be made at prevailing labor rates for 26 dollars per ton, and afford the mills a small profit. Now, at about 33 dollars, reduction in wages has already been made at some mills, and it is said that unless prices improve reduction will be general. There is a pretty large percentage included in the difference between 26 and 33.

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## Co-Operative Manufacture.

It must be admitted that co-operation in manufacture in this country has not met with the success that its friends predicted for it. Some co-operative manufacturing associations have gone steadily along in the way of a fair degree of success, but these have been the exceptions; more have resulted in dissatisfaction and discouragement of the members, and in practical failure. There must be reasons why these different results have obtained, and a careful study of these reasons ought to prevent failure in the future. Perhaps such study might lead to fewer attempts at co-operation, but that would be better than unsuccessful efforts.

It may be premised that when a number of men join together to carry on manufacture the conditions do not differ essentially from those that would exist in the instance of a single individual who should engage in the same business. In either case the business is likely to be started with moderate capital, the expectation being to add to this from the profits. In the case of the single individual the common result is that he goes on for years putting all the money he can save by close economy into more and better tools, and better facilities for doing work. For all these years he has probably less money to spend on himself than before he started his enterprise.

This is something not always, nor generally, thought of by those who go into similar business on the co operative plan. Their reason for working for themselves is that they may have more money to spend—and this is in every way commendable—than when they worked for others. But there is the same reason for frugality as in the instance of the individual; just as with him, the profits must go into better and increased facilities for doing work; and finding that they must, for years, actually live on less money than before, there is dissatisfaction. Unlike the single individual, who looks more to the future than at the present, they, or a large proportion of them, are likely to look almost entirely at the present. Their ideas are from observations of a business already successfully built up, and they are discouraged at the building up process. The reason is plain enough. The single individual, willing to sacrifice a good deal of comfort, and to work harder than ever before for what he hopes will come by and by is one man in a hundred. The ninety-nine would not be willing to work as he does, and would lack the quality of perseverance, and the ability to look ahead and count the cost from the beginning.

Looking at it another way, disappointment is likely to come to the co-operative members through too exalted ideas of the profit of manufacture. Assume that the single individual has all the capital he requires at the start and goes along with his business of manufacturing for twenty-five years, employing, say, one hundred men. If at the end of that time he could sell out his business and show a clear profit of one hundred thousand dollars, it would be considered that he had done very well indeed: his success would be far above the average. If his hundred workmen had started this same business, drawing the same out in wages as they would have received from the individual, and if they had managed equally well each would, at the end of the twenty-five years, have one thousand dollars as his share of the profits: forty dollars a year more than regular wages. This is something, certainly, but it is far below what is likely to be imagined, and hence unsatisfactory. The foregoing example of the individual manufacturer has been instanced as one of fairly good success. While instances could be cited in which success was far greater, many more could be found where it was less, or where the result was absolute failure.

There is another besetting weakness of co-operative association. The single individual has succeeded in increasing his capital by one hundred thousand dollars by virtue of being a good business manager. If the hundred men in co-operation succeed as well they must have equally as good a management. Men suited for such positions are rare, and generally able to command large salaries. But to the one hundred men, paying one man several times as much as they receive individually seems to be all wrong. And it never seems right to submit to the authority of one man; one of the reasons why they started business for themselves was to get rid of being managed. Granting they hire a good manager, the tendency is towards petty interference, and towards hedging him about with so many "committees," that, unable to act promptly, he resigns in disgust.

The stumbling blocks in the way of co-operation, a few only of which we have tried to point out, must be got around in the beginning of a co-operative enterprise, or they will prove troublesome. Workmen contemplating such a move should sit down and count the cost carefully. If not content with the prospects of a little more than wages from their business—and with even less than that for some years—they should keep out of such an enterprise. If content with this prospect, willing to go along about as if working for wages, and to work hard, taking the bad years with good ones, as a matter of course, paying for the kind of skill they do not possess, and refraining from encasing themselves in so much machinery of operation as to smother themselves, workmen may succeed in co-operation, taking success as it goes in manufacture. If they work more faithfully because working for themselves, this will be added to their profits, but this is a consideration of the case that is generally overestimated. The difficulty is in finding any considerable number of men who will all have carefully considered the matter from the beginning, whose estimates of success are moderate, who will persevere through times of little or no profit, and, above all, who will agree among themselves. A firm of ten or twenty equal partners would very likely find trouble from lack of harmony, and this lack of harmony is just as likely to prevail in co-operation.

## Consular Reports.

The consular reports on the condition and prospects of our trade in the various countries from which they come, may naturally be expected to be colored somewhat by the particular political or economic views held by the consul who makes them. Consuls are but human, and it is human nature to most readily observe those facts and circumstances which accord with, or seem to sustain, our own theories or preconceived opinions.

It is well known that if a man undertakes to conduct an experiment to determine any matter which is in doubt, he is very apt to so conduct the experiment, and so observe its results, as to sustain his preconceived opinion upon the matter, if he had any. He will do this in spite of himself, and notwithstanding that he may have had the most honest and sincere intentions, and had meant to conduct an absolutely fair experiment.

The United States Consul at Barranquilla, Colombia, in his report shows plainly that he has a decided leaning towards free trade. He reports that "Colombians will not purchase from American manufacturers, for the good reason that they can purchase the same wares from English manufacturers at 30 or 40 per cent less. * * * Within the next five years not less than one hundred cities in South America will establish waterworks, and all the material for these will be furnished by England. * * * Not a locomotive or railroad car can I see that is of American make; all are made in England. * * * Not one rail comes from the States—all are English," and so on. Then he says, "Let United States manufacturers ponder over this, for English manufacturers will furnish all this vast material unless our manufacturers are willing to compete with foreign manufacturers upon the merits of their wares alone." By this we suppose he means that American manufacturers must, by consenting to free frade, so reduce the cost of their wares as to enable them to compete with the English in neutral markets. Now, in this connection it is interesting to remember that in a recent issue of this paper, we published extracts from an article written by an Englishman for an English journal, showing that the English locomotive builders were being decidedly beaten in competition with Americans, both in quality and price.

The fact is, that if this consul were to be replaced by another who believed in the American doctrine of protection, his observations and conclusions drawn from them would be entirely different, and yet both men be entirely sincere in the matter.

We really do not think that the United States are in as much need of foreign trade in manufactured goods as many seem to think they are, and when they do really need it they will probably secure it.

## QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.*

(14) E. C. B., Denver, Col., asks: 1. Will you please inform me how to figure simple and compound gears for a lathe? *A.*—We refer you to question and answer No. 15 in this issue. 2. How can I "catch" threads of ¾ pitch on a lathe having a lead screw of five threads per inch, without backing belt; I measured back with my scale an even number of inches, but could not catch it. *A.*—When stopping a lathe at a certain place, opening the nut and running the carriage back to the proper place to catch the thread correctly, all that is necessary is to run back a whole number of threads, on both the screw being cut and the lead screw. In this instance you must run back 3 inches or 9, 12, 15, or some other multiple of 3. This is because 3 is the smallest number which is divisible by ¾ without a remainder. Three inches in this case is equal to 4 threads on the screw being cut, and 15 threads on the lead screw. 3. Is there a place in New York or the East where I could make expenses and learn drawing? *A.*—You are a machinist and could work at your trade and study drawing during spare hours in New York or elsewhere, and make probably something more than expenses. If you thoroughly study the articles now appearing in the AMERICAN MACHINIST, on Practical Drawing, you can obtain a good knowledge of drawing and remain where you are.

(15) J. R., Perry, Ill., asks: 1. What is the rule for finding change wheels for cutting any thread on any lathe. *A.*—If the lathe is simple geared, and the stud runs at the same speed as the spindle, then select some gear for the screw, and multiply its number of teeth by the number of threads per inch in the lead screw, and divide this result by the number of threads per inch which you wish to cut. This will give you the number of teeth in the gear for the stud. If this result is a fractional number, or a number which is not among the gears which you possess, then try some other gear for the screw. But if you prefer to select the gear for the stud first, then, multiply its number of teeth by the number of threads per inch which you wish to cut, and divide by the number of threads per inch on the lead screw. This will give you the number of teeth for the gears on the screw. If the lathe is compound, select at random all the driving gears, multiply the numbers of their teeth together, and this product by the number of threads you wish to cut. Then select at random all the driven gears except one; multiply the numbers of their teeth together, and this product by the number of threads per inch in the lead screw. Now divide the first result by the second, and you will have the number of teeth in the remaining given gear. But if you prefer, you can select at random all the driven gears. Multiply the numbers of their teeth together, and this product by the number of threads per inch in the lead screw. Then select at random all the driving gears except one. Multiply the numbers of their teeth together, and this result by the number of threads per inch of the screw you wish to cut. Divide the first result by the last, and you will have the number of teeth in the remaining driver. When the gears on the compounding stud are fast together, and cannot be changed, then the driven one has usually twice as many teeth as the other, or driver, in which case you can, in the calculations, consider the lead screw to have twice as many threads per inch as it actually has, and then ignore the compounding entirely. Some lathes are so constructed that the studs on which the first driver is placed revolves only half as fast as the spindle. You can ignore this in the calculations by doubling the number of threads of the lead screw. If both

the last conditions are present you can ignore them in the calculations by multiplying the number of threads per inch in the lead screw by four. 2. What is the best book on drawing, and the best method? *A.*—We recommend you to study the articles now appearing on mechanical drawing in the AMERICAN MACHINIST.

(16) **J. S., Brooklyn, N. Y., asks:** Can you inform me how I can magnetize small pieces of steel in large quantities? I have tried rubbing them on a magnet, but it don't work well, and besides, takes too long. *A.*—There are electric batteries adapted for such work which you can obtain of dealers, and by the use of which you can magnetize small articles strongly and rapidly.

(17) **H. G., Guelph, Ont., writes:** I am making a small model engine, the cylinder of which is 1 inch bore by 1 inch stroke. What size steam ports should it have? What size should the three ports be respectively? and what distance should each port be from the edge of the exhaust port? Also what should be the diameter of the steam and exhaust pipe? *A.*—See AMERICAN MACHINIST, Sept. 5, page 5, 1885, and Sept. 12, page 6, 1885. 2. Will a boiler (vertical) 9 inches high and 7 inches diameter, with two flues, each ¾ inch diameter, and 3 inch fire-box to burn charcoal be sufficiently large to run this engine? *A.*—That depends on the speed of engine and the pressure per square inch, which you do not state.

(18) **A. B. C. Lincoln, Ill., writes:** For a double cylinder engine 2 inches x 2½ inches, are the following ports of correct dimensions? Steam ports, 5-32 x 1¼ inches: exhaust ports, 5-16 x 1¼ inches. If so, what boiler pressure should be used to obtain 350 revolutions per minute, what should be the size of exhaust pipe, and what power would be developed? *A.*—In order to determine the boiler pressure we must know the amount of work which the engine is intended to perform, and since you do not state the amount of work, we cannot tell what boiler pressure you will need. The ports are rather small. For the correct proportions of steam ports, steam and exhaust pipes see AMERICAN MACHINIST, Sept. 5, 1885, page 5; and Sept. 12, 1885, p 6.

(19) **W. H. P., Richmond, Va., writes:** Can you inform me which is the best book on setting the slide valves on locomotive, marine, and stationary engines, and all questions relating to the steam boiler? *A.*—We do not know of a book which treats on the setting of the slide valve in all the three classes of engines. The setting of slide valves in a locomotive has been explained in the AMERICAN MACHINIST in a series of articles headed, "Modern Locomotive Construction," and it seems to us that if these articles are thoroughly understood, you will be able to set the slide valve on almost any engine. To get thoroughly acquainted with all the questions relating to the steam boiler, you will need several books, as each book may contain valuable information on some particular questions which others do not contain.

(20) **A. F., Akron, O., asks:** Will you please inform me how steel can be tempered, not only once, but every time, without cracking, as is often the case with an ordinary knowledge of hardening? I am manufacturing dies of all shapes, taps, punches, and cutters of different sizes and forms, and would like to become more skilled in the art of sure tempering. *A.*—Much depends upon the proper selection of steel, and it is of vital importance that it should be of the kind best suited to the purpose for which you propose to use it. Then it is important to secure an even heat, not only when the tool is ready for plunging, but it should be kept even during the entire process of heating. There are many things about the art, however, that can only be learned by experience. We do not think, though, that any one ever became skillful enough to entirely avoid cracking. There will always be more or less of it, in spite of every precaution.

(21) **A. J. W., Scranton, Pa., writes:** In the answer to Question 512, we find the following: "Is there anything better than clear water for washing blue prints? *A.*—Not that we are aware of." By referring to page 71, vol 2, of the Journal of the Engineering Society of the Lehigh University, we find the following: When the print is taken from the frame it is laid on a tray, and by means of a small hose a stream of water is directed on the sheet until its color is changed to a clear blue, and all the remaining soluble chemicals are washed off. The development may be hastened by using warm water. The blue tint may be intensified by using a dilute solution of hydrochloric acid, three parts, and water 100 parts, and washing again with water. *A.*—To the foregoing we will say that, as far as our knowledge goes, clear water is only used for washing blue prints in machine shop drawing rooms. We have used it for a number of years, and when the proper care has been exercised, the results have been excellent, and doubt if much better blue prints can be obtained by using anything else but clear water.

(22) **M. H. A., Pittsburgh, Pa., asks:** What will remove stains of copying ink from enamel cloth without destroying the cloth? *A.*—We never had occasion to remove stains of copying ink from enamel cloth, but if we were asked to do so, we should try one of the following receipts. The first one is that which is recommended for removing ink, iron moulds, etc., from linen. The second one is used for taking out stains of ink from books. 1. Take one ounce of oxalic acid in fine powder, mix with four ounces of cream tartar, and put it up in small oval boxes. Wet the finger in water, dip it in the powder and rub it on the spot gently, keeping it rather moist, and the stain will disappear without injuring the fabric. After the stain disappears wash the linen in pure water. The above is poisonous if swallowed. 2. To take out stains of ink from books, oxymuriatic acid removes perfectly stains of ink. Nearly all the acids will remove spots of ink from paper: but it is important to use such as do not attack its texture. Spirits of salt (muriatic acid) diluted in 5 or 6 times the quantity of water, may be applied with success upon the spot, and after a minute or two washing it off with clean water. A solution of oxalic acid, citric acid, and tartaric acid, is attended with the least risk, and may be applied upon the paper and plates without fear of damage. These acids taking out writing ink, and not touching the printing, can be used for restoring books where the margins have been written upon, without attacking the text.

(23) **W. W. J., Baltimore, Md., writes:** 1. I am going to build a small steam engine, cylinder 3¼ inches diameter, 6 inches stroke. I have bought all the castings in the rough. It has a round slide valve and circular ports in steam chest. What should be the size of the valve and size of steam ports? Also what should be the throw of the eccentrics? The engine is to make 250 revolutions per minute. *A.*—The area of the steam ports should be equal to about ⅛ of a square inch: the area of the exhaust port is often made equal to double that of the steam port, but this depends generally on the design of engine. We have not sufficient data to give the ratio between the breadth and length of ports. We believe that the information given in the AMERICAN MACHINIST, page 5, Sept. 5, 1885, will enable you to determine these dimensions. Besides this, it seems to us that the castings should indicate the size of ports. Also for the want of sufficient data we are unable to give the size of the valve. In order to determine the throw of the eccentric, the travel of the valve must be known, which depends on the width of steam port and the lap. And since we cannot determine the width of the steam port, for the want of sufficient data, we must refer you to the AMERICAN MACHINIST, page 2, Oct. 10, 1885; page 1, Oct. 24, 1885; page 4, Sept. 4, 1886; which will enable you to obtain the throw after you have determined the width of steam port and lap of valve. 2. How are the spiral springs made which are tapered at each end? *A.*—If only one or two are to be made, we believe you can make these on a mandrel of the proper shape in a lathe. If very many are to be made it is best to use special machinery for the purpose.

(24) **P. S., New York, writes:** In an answer to a question in one of your issues you state that, by use of forced blast, one square foot of heating surface will give 44 cubic feet of steam at a pressure of 100 pounds per hour, and in a good proportional tubular boiler with natural draught one square foot of heating surface will give 23 cubic feet at the same pressure per hour. Would you state to me how the example can be worked out at any given pressure, say at 80 pounds or at 70 pounds, so that I can find the heating surface of the said pressure? *A.*—The pressures given are supposed to be those indicated by the steam gauge, and since these pressures are all above the atmospheric pressure, and since in all calculation it is always best to consider absolute pressures, we must add 15 pounds to all the pressures taken from the steam gauge. Hence to find the heating surface suitable for a pressure of 80 pounds by the steam gauge, and based on the foregoing figures, we have the following rule: Divide 80 + 15 by 100 + 15, the quotient will be the fraction of a square foot of heating surface required for every 44 cubic feet of steam at 80 pounds' pressure per square inch, and forced draught, hence $\frac{95}{115} = .82$ square feet. To find the total heating surface, divide the given number of cubic feet of steam by 44, and multiply this product by .82: the product will be approximately the number of square feet of heating surface required. If natural draught is used and we wish to find the number of square feet of heating surface suitable for 80 pounds of steam, we have $\frac{80 + 15}{100 + 15} = .82$ square feet of heating surface for every 23 pounds of steam. Consequently, to find the total heating surface, divide the given number of cubic feet of steam required per hour by 23, and multiply the product by .82; the product will be approximately the number of square feet of heating surface required with natural draft.

(25) **A. B. C., Delano, Pa., asks:** What should be the principal dimensions of an engine with cylinder 3 inches diameter and 4 inches stroke, 150 pounds steam pressure, cut off at ¾ stroke and to make 350 revolutions per minute? *A.*—For thickness of metal in cylinder, see AMERICAN MACHINIST, page 2, Aug. 22, 1885. Steam and exhaust ports, page 5, Sept. 5, 1885. Steam pipes and exhaust passages, page 6, Sept. 12, 1885. Travel of valve, throw of eccentric and its position, page 2, Oct. 10, 1885; page 1, Oct. 24, 1885; and page 4, Sept. 4, 1886. For determining the lap of valve for cutting off at ¾ of the stroke, page 4, Nov. 7, 1885, and page 6, Nov. 21, 1885. Inside lap and clearance, page 4, Dec. 12, 1885. Pistons, page 6, June 11, 1887, and June 25, 1887. Crossheads, page 2, July 9, 1887; page 2, July 23, 1887. 2. Would you recommend building a compound engine with cylinders 3 inches and 5 inches in diameter, 6 inches stroke, steam ports, H. P. ¼ inch x 2¾ inches, and L. P. ⅜ inch x 4 inches; engine to use steam at 175 pounds pressure, and 300 revolutions per minute? If not, please state your objections to compounding so small an engine. The practice abroad is toward compounding and even triple expansion for sizes very little larger than this. If you have any suggestions as to sizes or dimensions please state them, as I wish to see it given a practical test. *A.*—Engines of this size are too small for compounding, we cannot recommend them. 3. Can you give me the composition of the white metal that the British marine engineers use to coat the steel crank shafts with for bearings. It is also used for crosshead shoes or slippers. How is it securely fastened to the iron or steel? *A.*—We are not aware that British engineers line the journals of shafting with any kind of white metal. But in the bearings for these journals they use Babbitt metal or a white metal similar to it.


## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*

Gear Wheels. See Adv., page 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass

Lamb Knitting Machine Co., Chicopee Falls, Mass.

Machine work and patternmaking. Anderson Machine Works, Peekskill, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

For Electric Recording Steam Gauge, write Telemeter Co., 44 Barclay st., New York.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Drop presses, punches, and shears. Williams White & Co., Moline, Ill., manufacturers.

For catalogue of 2d hand lathes, planers, etc., write to John Steptoe & Co., Cincinnati, O.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N.Y.

Buy the Excel Upright Drill; sizes 20", 25", 28", 32", 36" swing. Currier & Snyder, Worcester, Mass.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Berryman Patent Feed Water Heater and Purifier, and the Economic Boiler Feed Pump. Benj. F. Kelley, 91 Liberty st., New York.

Nicholson & Waterman, Providence, R. I., one 46 in. horizontal boring mill; 5 in. cutting-off machines; 14, 16, and 30 in. engine lathes.

The Brown & Sharpe Mfg. Co. have placed at No. 23 S. Canal st., Chicago, Ill., a sample line of milling machines and other machinery with S. A. Smith.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Geo. S. Brown's (2290 Washington st., Boston) machinery wiper; incombustible, durable, effective; 10c. each, $5 hundred; better and cheaper than waste.

For Best Return Steam Traps Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

W. H. Hoffman, consulting engineer, 94 Liberty st., N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water air and electricity.

A. K. Mansfield & Co., mechanical engineers and experts in machinery patents; 18 years' experience; convincing references; practical working drawings, estimates, supervision. Room 256, 280 B'way, N. Y.

Hot Water Supply. A practical treatise on the fitting of hot-water apparatus for domestic and general purposes. By F. Dye. 82 pages, with 25 illustrations. 12mo., cloth, $1. Send for catalogue. E. & F. N. Spon, 35 Murray st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Practical Drawing and Modern Locomotive Construction. By J. G. A. Meyer. The articles on Practical Drawing commenced with Oct. 23 1886 issue, up to and including Dec. 31, 1887 issue, 40 papers have been published. Price, 5c. each. Locomotive Construction commenced with June 27, 1885 issue, up to and including Dec. 24, 1887 issue, 54 papers have appeared. Price, 5c. each. Any or all of the numbers can be supplied. AMERICAN MACHINIST Publishing Company, 96 Fulton street, N. Y.

The 28 in. lathe illustrated in the MACHINIST some weeks ago has proved very satisfactory. They have been quite generally distributed, being now in Maine, Chicago, Texas, Mexico, and other sections. It is the best lathe for the price now produced, being mechanically designed and strongly proportioned. They are all carefully tested before leaving the shop, and their accuracy guaranteed. These lathes and a large assortment of other machine tools can be seen at the warerooms of Fraser & Archer, No. 121 Chambers street, New York.


## MANUFACTURES

Frank Cleveland will build a steam saw mill at Moscow, Me.

West & Card, Franklin, Maine, will build a large steam lumber mill.

The Detroit (Mich.) Sheet Metal Company will build works at Detroit.

W. H. Miller is interested in building a cotton mill at Charlotte, N. C.

The Knebel Engine Company is the name of a new company at Birmingham, Ala.

E. L. Maslin is interested in building a spoke and handle factory at Huntsville, Ala.

Ellis & Son, Athol, Mass., have completed an addition to their sash and blind shop.

Helfer & Son, carriage manufacturers at Indianapolis, Ind., will build an addition to their works.

Wm. Marshall will build a five-story factory on the corner of 71st street and Avenue A, New York.

L. S. Graves & Son, Rochester, N. Y., send us a well-illustrated catalogue of freight and passenger elevators.

Sherman & Company, Belfast, Me., will build a new factory 30 x 100 feet, for the manufacture of leatheroid.

Smith Bros. & Co., Allegheny, Pa., have purchased a tract of land upon which they will build a large steel mill.

The Barbour Machine Works will move from Eufaula to Anniston, Ala. They will manufacture agricultural implements.

The Beaudry press was awarded the silver medal and diploma at the Massachusetts Charitable Mechanics' Association fair at Boston, Mass.

The old Gore Foundry on Center avenue, Chicago Ill., has been leased by Kennedy & Fyffe. They will make a specialty of rolling mill work.

The Schenectady Locomotive Works, Schenectady, N. Y., are building a blacksmith shop 85 x 350 feet. It will be lighted by incandescent lights.

The National Tube Works, McKeesport, Pa. has succeeded in making perfectly welded 24 inch pipe. This is said to be the largest pipe ever made by the roller process.

The Sterling Emery Wheel Company has opened an office at 22 Warren street, New York. They will keep a full assortment of emery and corundum wheels, also emery grinding machinery.

The estate of F. W. Richardson, Troy, N. Y., are doing an excellent business in manufacturing the Richardson and the Richardson-Allen balance valves. Their orders keep them working overtime.

We have received a neat illustrated circular of the Overhead Conductor Electric Railway Company, Pittsburgh, Pa. The circular is fully illustrated, and contains copies of the patents relating to this system.

The Ferracute Machine Company, Bridgeton, N. J., send us circulars in the shape of four large illustrations, marked "List" 11, 12, 13, 14 and 15. These lists contain concise descriptions of a great variety of punches, presses, dies, etc.

J. Stevens & Co., Chicopee Falls, Mass., send us a catalogue containing some additions to their previous catalogues. It contains illustrations and short descriptions of a large variety of machinists' tools, such as calipers, dividers, gauges, etc.

The Waterhouse system of electric lighting, manufactured by the Waterhouse Electric and Manufacturing Company, Hartford, Conn., has been awarded the gold medal at the fair of the Charitable Mechanics' Association, Boston, Mass., just closed. The award was based on the judges' report of the tests of the capacity of the apparatus in governing arc lighting circuits, and also the peculiar use of magnets, both requiring the exercise of a high degree of inventive skill and applied science of great value, etc., etc. This was the first exhibition made by the Waterhouse Company.

A certificate of incorporation has been issued to the National Hot Water Heater Company, of Boston, who are to undertake the manufacture and sale, in the United States, of the Spence hot water boilers for heating buildings by hot water circulation. These heaters have been made and extensively sold throughout the Dominion of Canada by Rogers & King, of Montreal. James C. King, of Montreal, is president, and Daniel Simonds, vice-president and treasurer of the Simonds Manufacturing Company, of Fitchburg, Mass., is treasurer. The offices of the company are at 191 Fort Hill square, Boston, Mass.

The hay-knife factory of Hiram Holt, at East Wilton, was burned Tuesday night. Some 300 dozen knives in process of making were ruined, together with about 20 tons of steel and $500 worth of grindstones, and twenty-five men are thrown out of employment. The packing houses were saved, containing some 2,800 dozen finished knives, and therefore the shipping of orders will not be interfered with. Mr. Holt has lately transferred his plant and water-power to a stock company, which, however, bore his name, and in which he held the controlling interest. The loss is stated in the press dispatches to be about $25,000, with no insurance. It is thought that the works will be rebuilt. Mr. Holt is one of the energetic and enterprising business men of the State, and the industry he established and successfully conducted was of a kind that is of great benefit to its community and highly creditable to Maine. *Industrial Gazette.*

## Machinists' Supplies and Iron.

NEW YORK, Dec. 29, 1887.

Iron—Transactions in American Pig have been of a moderate character during the past week, and there is every probability that they will continue so till large producers give some indications of their course for the year 1888. Consumers rather fear for lower prices than hope for them, and it is doubtful if there will be much tendency to buy in quantity for some months at least, without regard to whether prices go up or down. Standard Lehigh brands are held firm, but other brands not so strong. We quote Lehigh $21 to $21.50 for No. 1 X Foundry, but outside brands are obtainable at $20 to $20.50. No. 2 X is quoted $19 to $19.50 for Standard brands, but others can be had at $18 to $18.50, and Grey Forge ranges from $16 to $17.

## ✻WANTED✻

*"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.*

Wanted—Men to sell planes, see page 11.

Wanted—Machinist with experience on cylinder printing presses. Address, stating age, experience, and salary required, Golding & Co., Boston, Mass.

Mechanical engineer and designer, competent as supt., head draftsman, or engineer, desires to change; Corliss engine expert. Indicator, AM. MACHINIST.

Wanted—Superior salesmen, understanding steam enginery; apparatus expensive; entire time; commission only. Give references and experience. G. N. D., AM. MACHINIST.

Wanted—Situation as foreman blacksmith; locomotive work preferred; great experience in Europe and America; great saving guaranteed; distance no object. W. J., AM. MACHINIST.

Wanted—Position as supt. or foreman, by young man; has held same for number of years, on fine tools, interchangeable work and automatic machinery; is good draughtsman; best references. W. H. S., 1331 So. 16th street, Philadelphia, Pa.

Wanted—In the West, foreman, bright and competent in controlling men and assembling small turret and fox lathe work, etc. rapidly. Address B. R., care AM. MACHINIST, giving age, detailed experience, reference, etc.

Wanted—Situation by competent draftsman and designer; graduate of school of technology; 16 years' experience in mechanical business; designed a variety of machine tools and had charge of toolmakers; good testimonials as to skill and conduct furnished. "W—38 years," AM. MACHINIST.

Wanted—A first-class brass moulder; one capable of taking charge of a brass foundry where there are 8 to 10 brass moulders employed; must have a thorough knowledge in the mixing of metals, and of engineers' and plumbers' brass castings. Address, stating age, experience, salary expected, and references, Box 79, AM. MACHINIST, N. Y.

## ✢ MISCELLANEOUS WANTS. ✢

*Advertisements will be inserted under this head a 35 cents per line, each insertion.*

Crescent solid lubricant, clean, durable, cheap, prevents hot boxes. Crescent Mfg. Co., Cleveland.

The Crescent automatic grease cup is adapted to every service. Crescent Mfg. Co., Cleveland, Ohio.

Wanted—Parties having machinery specialties to build, to correspond with. Box 75, AM. MACHINIST.

I want to buy some specialty patents or manufacture on royalty; give description or patent. Address F. D. Cummer, Cleveland, Ohio.

Steam users who desire to keep their boilers clear of scale at a cost of 10 cents a week, should read the card of the Pittsburgh Boiler Scale Resolvent Company on this page. It will pay them.

A. C. Christensen, 26 Church st., N. Y., mech. and hydraulic engineer, late chf. draftsman at H. R. Worthington. Designs and working drawings of water-works, pumps, gen. mach. and pat. drawings.

Engine and boiler for sale; an 80 horse-power Buckeye automatic engine and 120 horse-power boiler with heater, exhaust injector, damper regulator, piping, etc., in excellent order. Will be sold at a great bargain. Address P. O., Box 40, Troy, N. Y.

For Sale—39″ x 12′, 24′ x 16′, 18″ x 9′ screw cutting lathes; Daniels wood planer, 20″ x 18′; Hotchkiss belt power hammer, ram 100 pounds, air cylinder, 4″ x 16″; all second-hand, in good order. J. & G. Rich, 120 N. 6th st., Phila., Pa.


**BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER**

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

**Bradley's HEATING FORGES**

*With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements.*

For hard coal or coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.

**BRADLEY & CO.,** Syracuse, N. Y.

**STEPHENS PATENT VISES.**

ONE-HALF TIME and LABOR saved by using this solid, strong, durable, firm-hold, quick-working Lever (Not Screw) Vise. Has improved Taper-Pipe and other attachments. Sold by the trade. Send for circular

TOWER & LYON,
95 Chambers Street, New York.
Successors to MELVIN STEPHENS.

**STEAM PUMPS** for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar; for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids; for Thick, Volatile, Viscous or Foul Liquids, etc. VACUUM PUMPS of the highest efficiency. FILTER PRESS PUMPS. Air, Gas and Acid Blowers. AIR COMPRESSORS. Etc. BUILT BY

**GUILD & GARRISON, Brooklyn, N. Y.**

**Baker's Common Sense Oil Filter.**

Is the most **Simple, Neat, Ornamental, Effective, Complete** and **Convenient OIL FILTER** in the Market. The whole **operation** is **visible,** and any ordinary man can operate it **successfully.** It will pay for itself the first year, if a little pains is taken to catch the waste oil from your Engine, Dynamo, Shafting, etc., etc. Manufactured and for sale by **CHAS. F. BAKER,**

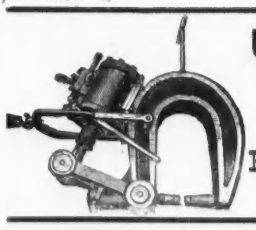
223 Third Ave., S. E., MINNEAPOLIS, MINN.

THE
**Association of Engineers**
OF
WAYS AND COMMUNICATION,
OF
**ST. PETERSBURG, RUSSIA.**

Having special Government charter favoring negotiations on a large scale and doing already a heavy business in Europe, invites American Manufacturers, Inventors and Engineers of all branches to participate in the permanent exhibition at St. Petersburg with first class prospects of doing a profitable business.

GENERAL AGENT FOR AMERICA,
**A. WARSCHAWSKY,**
P. O. Box 3,348. 14 Day St., N. Y.

**THOS. H. DALLETT & CO.,**
**1305 Buttonwood St., Phila., Pa.**
MANUFACTURERS OF
**PATENT PORTABLE DRILLS,**
HAND DRILLS, BOILER-SHELL DRILLS, MULTIPLE DRILLS,
Light Drill Presses, Special Machinery, &c, &c.



**U. BAIRD MACHINERY CO.**
**Pittsburgh, Pa.**
MACHINISTS' TOOLS AND SUPPLIES.
Pattern Makers' Tools. Boiler Makers' Tools.
STURTEVANT BLOWERS AND EXHAUST FANS.

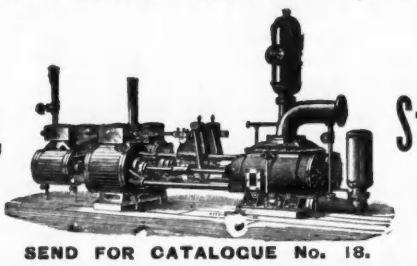
**GEO. F. BLAKE MANF'G. CO.**
BUILDERS OF EVERY VARIETY OF

95 & 97 LIBERTY ST., NEW YORK. 111 FEDERAL ST., BOSTON.

WATER WORKS PUMPING **ENGINES A SPECIALTY**

**THE DEANE STEAM PUMP CO., Holyoke, Mass.**

BUILD Water Works, ENGINES AND Steam Pumping MACHINERY.



SEND FOR CATALOGUE No. 18.

**AS we are filling up our works with Engine Lathes of our own make, we offer a variety of second-hand Engine Lathes of various makes, ranging in size from 14 in. x 6 ft. to 23 in. x 10 ft. These Lathes will be thoroughly overhauled and put in first-class order, and sold at reasonable prices.**

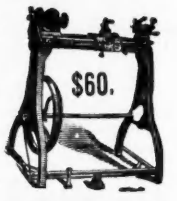
**THE HENDEY MACHINE CO., Torrington, Conn.**

**DIE STEEL IN BARS OR BLOCKS.**

For Cutting, Trimming, Stamping Punching, Drop Forging, Bolt and Rivet Heading Dies for Hot or Cold Work.

**MILLER, METCALF & PARKIN,**
CRESCENT STEEL WORKS.
CHICAGO, ILLS. PITTSBURGH, PA. NEW YORK, N. Y.

Sebastian, May & Co.'s Improved Screw Cutting
FOOT AND **LATHES** POWER




Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

167 West Second Street, CINCINNATI, O.

**PURE CARBON BRONZE.**

Heavy Journal Bearings our Specialty.

Specially adapted for use on Steam Engines Heavy Machinery, Locomotives, &c.

Look for brand, "Pure Carbon Bronze."

**CARBON BRONZE CO.,**
SOLE MANUFACTURERS,
38 WATER ST., PITTSBURGH, PA.

**For Sale—A Great Bargain.**

The Madison Manufacturing Company's Machine Shops, Buildings (brick and stone), Iron and Woodworking Machinery (nearly new). Foundry, Patterns. Ample grounds.

Address JOHN W. HUDSON,
Madison, Wis.

**TANITE**
EMERY WHEELS and GRINDING MACHINES
FOR SAW MILLS, FOUNDRIES AND MACHINE SHOPS.
For Circulars address
THE TANITE COMPANY, STROUDSBURG, MONROE CO., PA.
Or H. A. ROGERS, 19 John St., N. Y.

Thinking engineers recognize that the use of chemicals in steam boilers to prevent incrustations has had its day.

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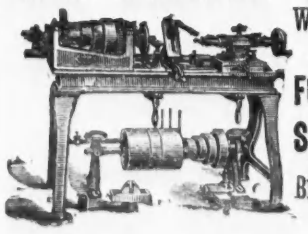

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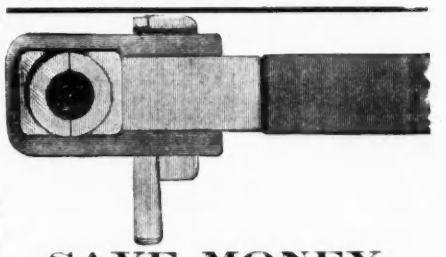

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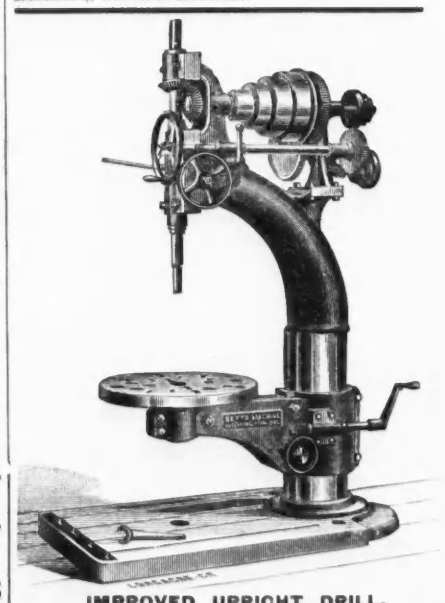

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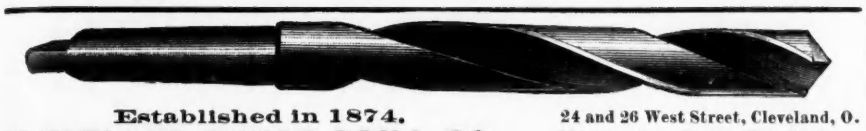

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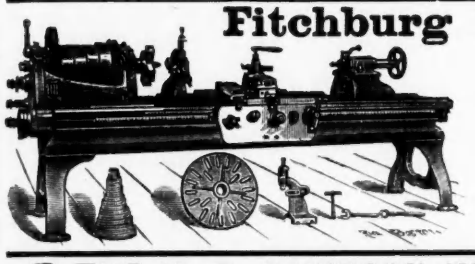

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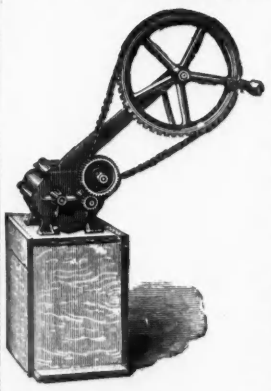

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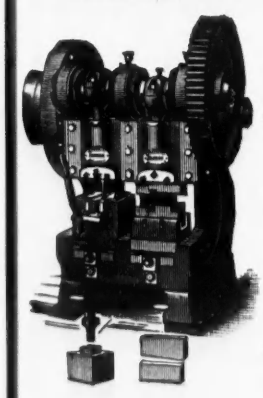

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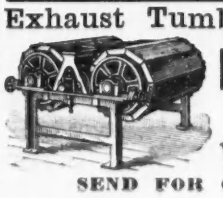

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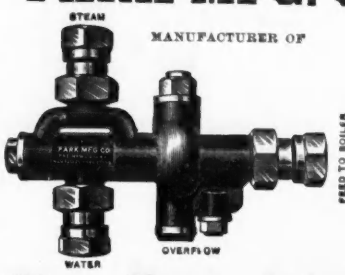


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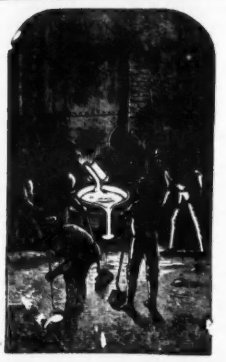

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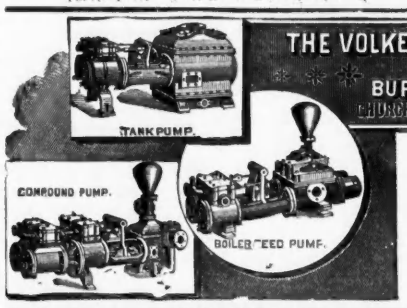


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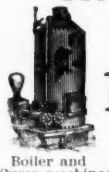

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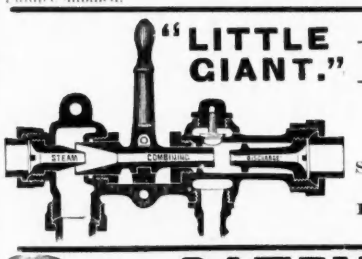


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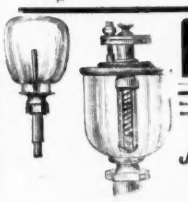

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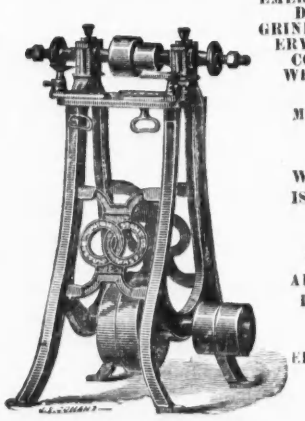

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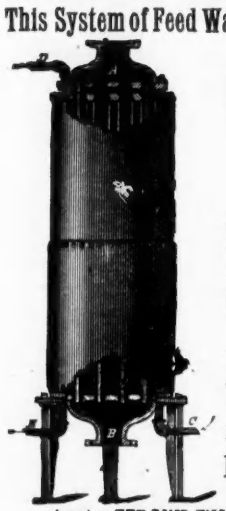

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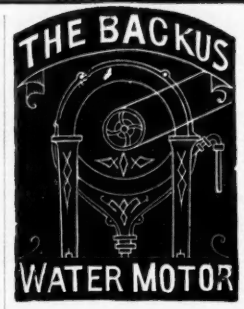


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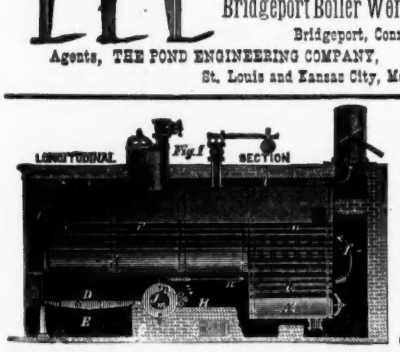


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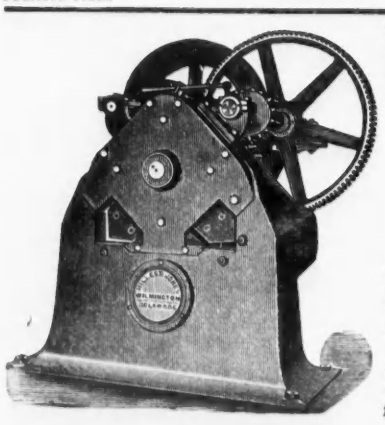

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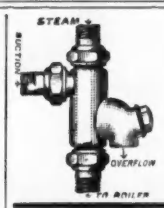

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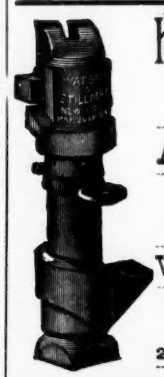

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Are guaranteed to be right in all respects. Ask to see them at your dealer's, or write direct to the factory. Respectfully,

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Manufacturers of Set, Cap and Machine Screws, Studs, etc.

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CARRY A LINE OF BOILERS IN STOCK FOR IMMEDIATE DELIVERY.

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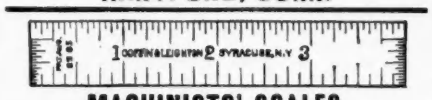


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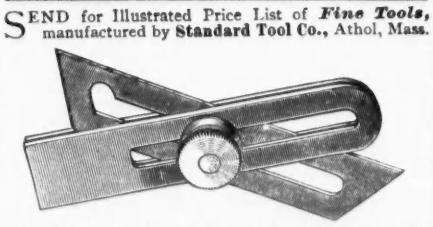

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**Punches and Dies,**

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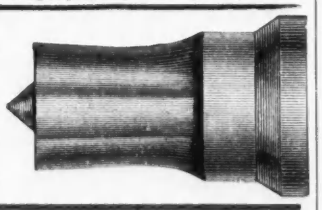

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SMOOTH INSIDE & OUT.

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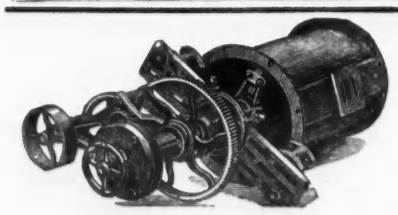

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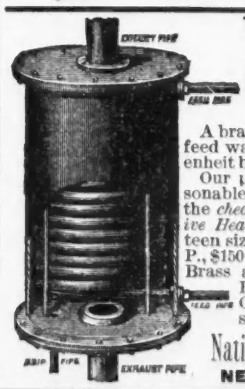

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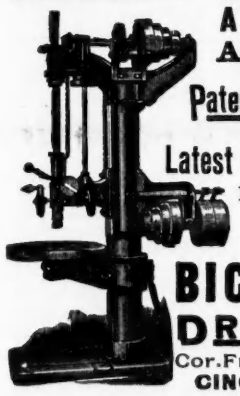

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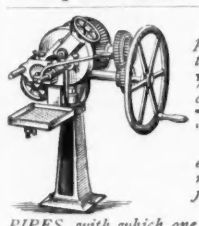
*"Eclipse" Hand Pipe-Cutting Machines.*



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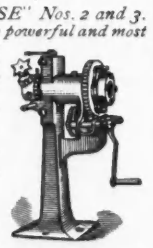

*No. 2 Cuts and Screws 2½ to 4 in.*
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*It will pay you to write us for particulars.*
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Manufacturers of and Dealers in
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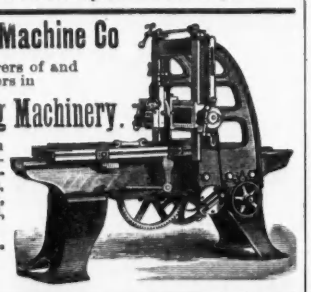

Improved Iron Planers a specialty. Feed, patented Feb. 9, 1886. Belt Shifter, patented Nov. 2, 1886.
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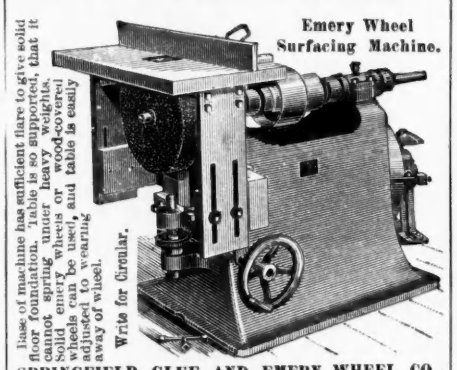

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Base of machine has sufficient flare to give solid floor foundation. Table is so supported, that it cannot spring under heavy weights. Solid emery wheels or wood-covered wheels can be used, and table is easily adjusted to wearing away of wheel.
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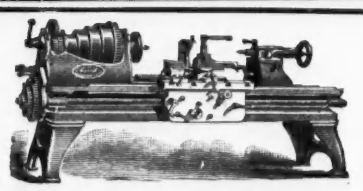

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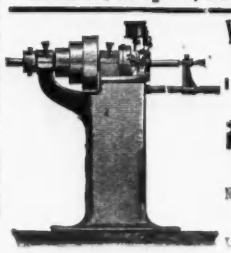

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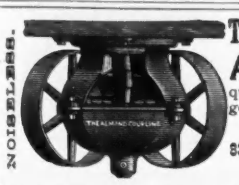


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A NEW quarter turn motion to replace quarter turn belts and bevel gears.
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STEAM AND GAS FITTERS' HAND TOOLS.
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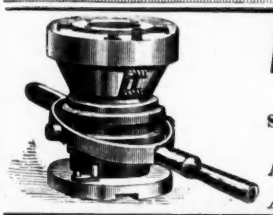

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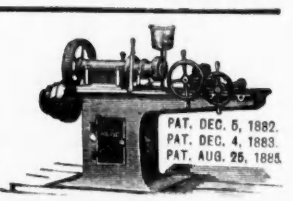


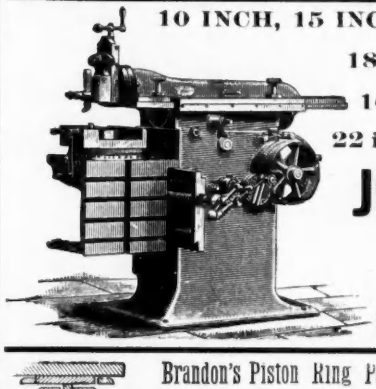

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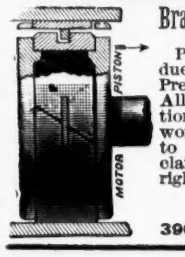


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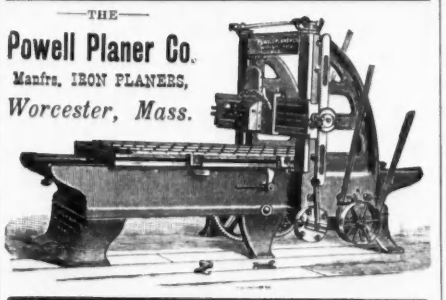

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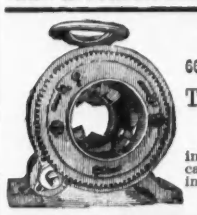

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Pipe Cutting and Threading Machine, etc.
A portable cutting and threading machine with which one man can with ease thread pipe up to six inch diam. No vise is required.
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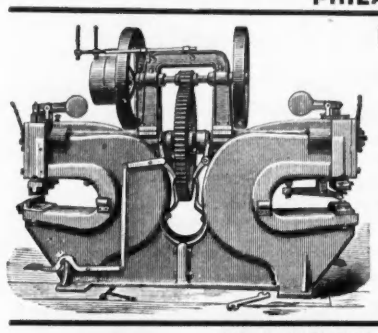

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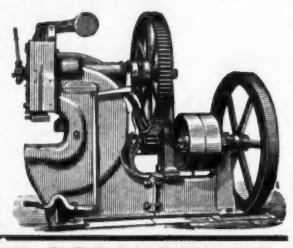

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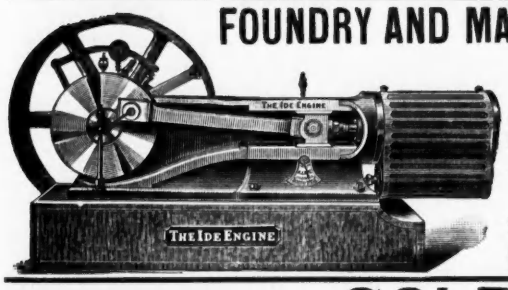


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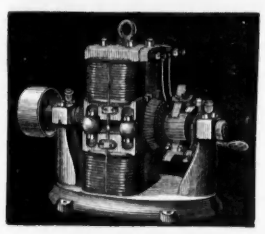

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We positively claim an improvement in Electric Lighting. INVESTIGATION INVITED.

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1 36 in. x 16 ft. bed, treble-geared "
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1 40 in. x 36 in. x 12 ft. stroke **Planer.**
1 36 x 36 x 9 ft. stroke **Planer.**
1 72 **Pulley Turning Lathe.**
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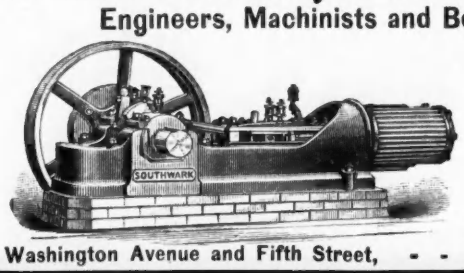
Engineers, Machinists and Boiler Makers,




SOLE MAKERS
Porter-Allen & Southwark Engines.
Blowing & Reversing Engines, Steel & Hydraulic Machinery, Boilers, Tanks, and Gas Apparatus.
INQUIRIES SOLICITED.
Washington Avenue and Fifth Street, - - - PHILADELPHIA, PA.

## BEMENT, MILES & CO.,

PHILADELPHIA, PA.
—BUILDERS OF—
## METAL-WORKING MACHINE TOOLS
FOR
**Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works,**
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A FEW PRACTICAL OPINIONS OF
## THE OPEN SIDE PLANERS.
No. 4.

HENRY DISSTON & SONS STEEL WORKS.

Messrs. Detrick & Harvey, Baltimore, Md. Tacony, Pa., Dec. 5th, 1887.

Dear Sirs:
In reply to yours of the 29th, asking how the planer we purchased from you some time ago was working, I am glad to say that it is doing nicely. We use it on all kinds of work and have found it A1 on everything.
It enables us to do much larger work than we could do on any other planer of an equal or much larger size. We find it as stiff and rigid as any other style. We would not now do without it.
We congratulate you on your success. Yours etc.,
S. T. WILLIAMS, Gen'l Manager
Henry Disston & Sons Iron & Steel Co.

PHOTOTYPES, PRICES, ETC., ON APPLICATION.
**DETRICK & HARVEY, Manufacturers, Baltimore, Md.**

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Section of **Copper-Wire-Sewed Light Double Belting,** specially adapted to use on cone pulleys and other hard places. Manufactured by the **PACE BELTNG CO., Concord, N. H.** Also manufacturers of Staple and Special Grades of Leather Belting and the *"HERCULES"* Lacing. Send for Catalogue No. 2.

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*HOISTING ENGINES, ELEVATORS, STEAM AND BELT POWER.*
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Superior Design & Workmanship, Extra Heavy (1500 lbs.) DOWN, ANGULAR AND CROSS-FEED, TO PLANE 12x16x15.
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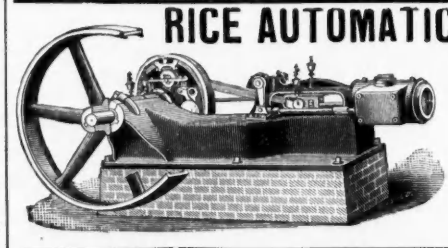
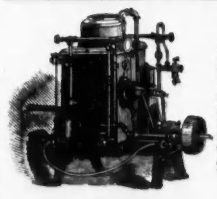


*Self-Contained. Sensitive Governor. Balanced Valve. High Speeds. Stationary Oilers. Best Economy.*

*Gold Medal Cincinnati Exposition, 1884.*

## THE JOHN T. NOYE MFG. CO.,
BUFFALO, N. Y.



## OIL ENGINES.

For Printers, Steam Yachts, pumping water, sawing wood, making ice-cream, Carpenters, Mechanics. 1 to 5 H. P. Fuel, Kerosene. No dust. Automatic in fuel and water supply. Illustrated Catalogue free. Mention AMERICAN MACHINIST.
SHIPMAN ENGINE CO.,
92 Pearl St., Boston, Mass.

## CURTIS RETURN STEAM TRAP

For returning steam, condensed under pressure, automatically into the boiler, under high or low pressure,
Manufactured by
CURTIS REGULATOR CO.
Boston, Mass.
General Agencies:
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66 N. 4th St., Phila., Pa.
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Send for Circular No. 17.

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12 Sizes.
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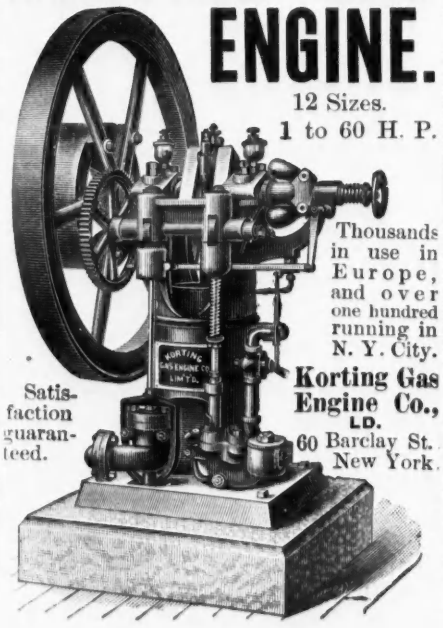

Thousands in use in Europe, and over one hundred running in N. Y. City.
Satisfaction guaranteed.
**Korting Gas Engine Co., LD.**
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FOR HEAVY WORK & LARGE POWERS. EXTRA HEAVY DESIGN.
Send for Catalogue.
**WILLIAM TOD & CO.,**
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*75* Portable and Stationary Steam Engines and Boilers, both new and second-hand, in a great variety of sizes, from 2 to 75 H. P. Steam Power and Drainage Pumps for all kinds of duty. One second-hand Portable Steam Saw Mill, one large second-hand Punching Press. Shafting, Pulleys, Hangers and Belting. Parties in need of Machinery will do well to correspond with us for prices.

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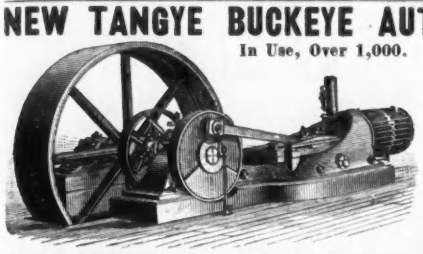
## NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. 25 to 1,000 H. P.



These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H. P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

**SALES AGENTS: W. L. SIMPSON,** 301 TELEPHONE BUILDING, 18 CORTLANDT STREET, N. Y. {N. W. ROBINSON, cor. Clinton & Jackson Sts., Chicago, Ill. {ROBINSON & CARY, St. Paul, Minn.

**KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.**

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

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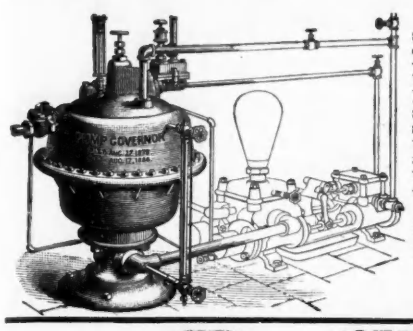

For use in returning the water of condensation to steam boilers under circumstances which make the employment of the steam trap undesirable, as where the pressure in heating systems is greatly reduced below boiler pressure, or where sufficient head room is lacking. Is used in connection with a steam pump, so controlling the action of the pump that its piston speed is at all times exactly proportionate to the varying quantity of water to be returned. No stuffing boxes are used in its construction, and friction is reduced to a minimum. Can be adapted to suit a wide range of conditions.

Send for circular of **Blessing's Albany Steam Trap, Blessing's Water Circulator and Purifier, and Blessing's Renewable-Seat Stop and Check Valves.**

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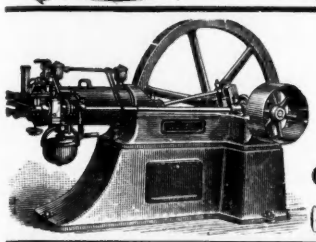

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OVER 25,000 ENGINES IN USE.

GUARANTEED To Consume 25 to 75 Per Cent. Less Gas than ANY Other Gas Engine doing the same work.

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Non-Condensing, Condensing, Compound,

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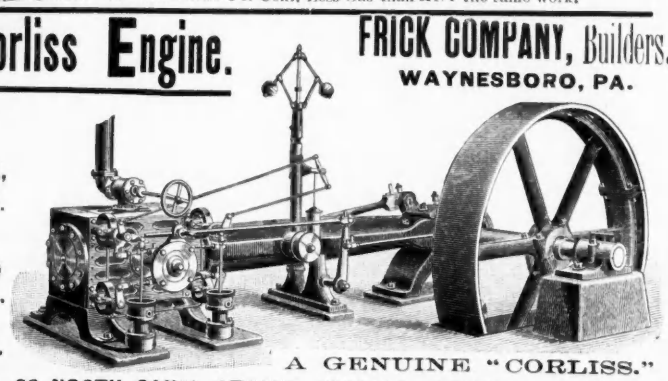

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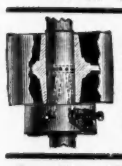

No more trouble with Loose Pulleys. ORMSBY'S PATENT SELF-LUBRICATED PULLEY BEARING settles the business. Can be used on old or new shafts, and in any position. Send for circular and price list.
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BUILDERS OF IMPROVED
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**New and Second-hand, on Hand.**

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| 12 in. x6 ft. | Engine Lathe, | | new |
| 13 in. x6 ft. | " | Ames, | " |
| 14 in. x6 ft. | " | Blaisdell, | " |
| 16-20 in. x6-8-10 & 12 ft. | | Bridgeport | ew. |
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| 24 in. Shaper, | | Bridgeport, | new. |
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| No. 1 Screw Machine, Wire Feed, Pratt & Whitney | | | |
| 16-18-20-23 25-28-34 in. Drills. | | 30 in. Radial Drill, | |
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Milling Machines, Screw Machines, Slate Sensitive Drills, Gang Drills, and full line of all kinds of Machine Tools. Send for list and specify what is wanted.

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**VOLNEY W. MASON & CO.,**
Friction Pulleys, Clutches and Elevators.
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## To Buyers of Engine Lathes

We are now making from entirely new designs, *extra heavy* 17", 19", 21", 24" and 27" Engine Lathes (the most popular sizes), of which we are making a specialty, and manufacturing in lots of not less than 100 at a time.

We make no charge for extras. Every lathe is furnished with *hollow spindle*; the 19" with 1⅛" hole, and 21" with 1⅜" hole. Every lathe has substantial *compound rest*, heavy tool post (bar steel), rest to turn full swing, *following rest* with adjustable jaws to take any size from 2½" down, with extra tool for shafting.

Full set of gears to cut from 2 to 18 threads including 11½ pipe thread. *Automatic stop on carriage. Separate screw and rod feed*, and the most substantial and easily managed *taper attachment* made. Cones and gears of large diameter and wide belt. Studs, screws and small gears are *steel or gunmetal*. Webbed live heads, heavy tail stocks. No worm or worm gears, no weak reverse plate. *Perfect lubrication for all running parts*, including carriage.

Lead screw inside of shear, double nut (cut from solid), and taking hold of carriage directly under the line of strain. Friction counter-shaft, the most durable made. Our prices are reasonable for cash, and from which no deviation will be made. Our written guarantee accompanies every lathe.

**GUARANTEE.**

We guarantee this lathe to be equal in workmanship, truth, accuracy, solidity, material and finish, to the best made, and hold ourselves legally liable for this guarantee.

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MANUFACTURERS

**Machine Tools,**

159, 161, 163 and 165 EGGLESTON AVE.,
136, 138, 146, 148, 150, 152, 154 E. 6th St.,

**CINCINNATI, OHIO.**

(See our advertisement on last page.)

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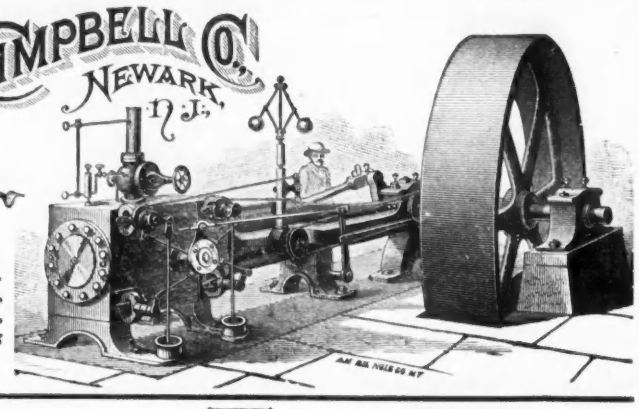
NEWARK, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

Sizes Varying from 30 to 2000 Horse Power.

Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound.

Send for Circular.



## The Hewes & Phillips Iron Works

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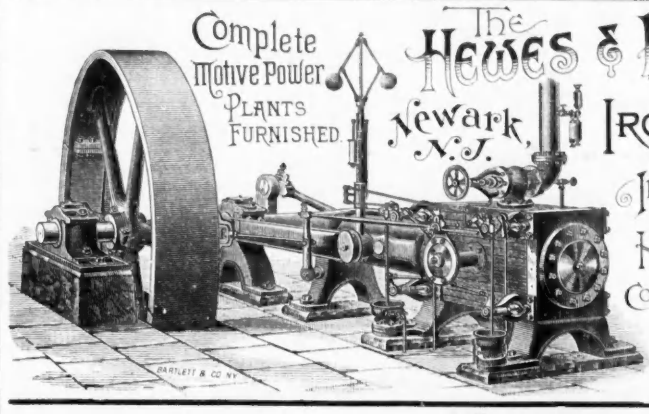
Complete Motive Power Plants Furnished.



Improved CORLISS ENGINES, High Pressure, Condensing and Compound

TUBULAR BOILERS.

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## THE IMPROVED FISHKILL CORLISS ENGINE

BUILT BY THE FISHKILL LANDING MACHINE CO.,

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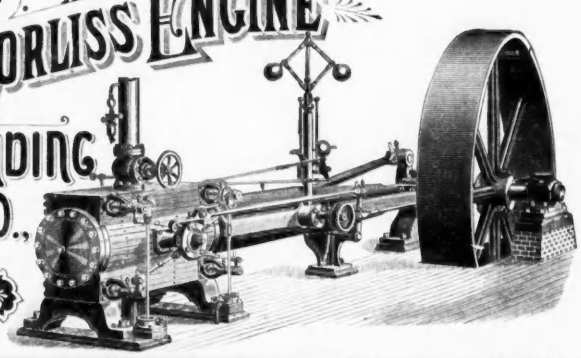

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MANUFACTURER OF IMPROVED
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ALSO SLIDE VALVE ENGINES
STATIONARY BOILERS,
GENERAL MACHINERY,
IRON AND BRASS CASTINGS.

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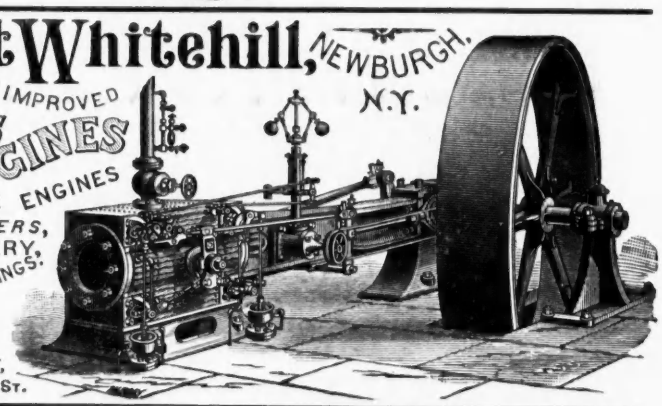
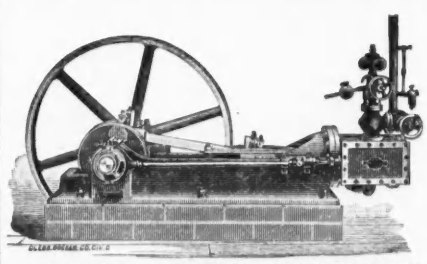
Room 6,
COAL AND IRON EXCHANGE,
COR. CORTLANDT & CHURCH ST.





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ENGINES from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

**SAW MILLS and GENERAL MACHINERY.**

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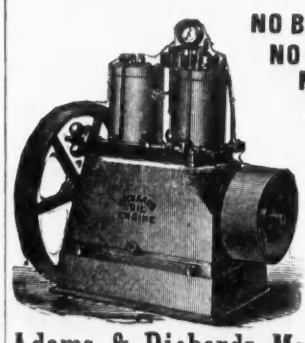
SMITH & BARNHURST, · · · MANAGERS.



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**NO STEAM.**
**NO DANGER.**

FUEL, CRUDE PETROLEUM OR KEROSENE.

Started instantly with a match.

Cheaper than all others.

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New Brunswick, N. J.

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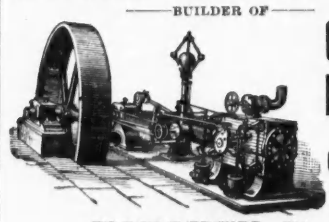

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**IRON-WORKING MACHINERY ON HAND.**

**156 to 164 Oliver St.,**

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One Second Hand Whitcomb planer, planes 30" by 30" by 10'.

One Second-Hand N. Y. Steam Engine Co. Car Wheel Borer, with Hub Facing Attachment and Crane.

One New Putnam Screw Cutting Engine Lathe, 36" Swing, 18' Bed.

One Second-Hand Putnam Screw Cutting Engine Lathe, 42" Swing, 14' Bed.

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PROVIDENCE, R. I., U. S. A.

FINE MACHINERY, TOOLS OF PRECISION.

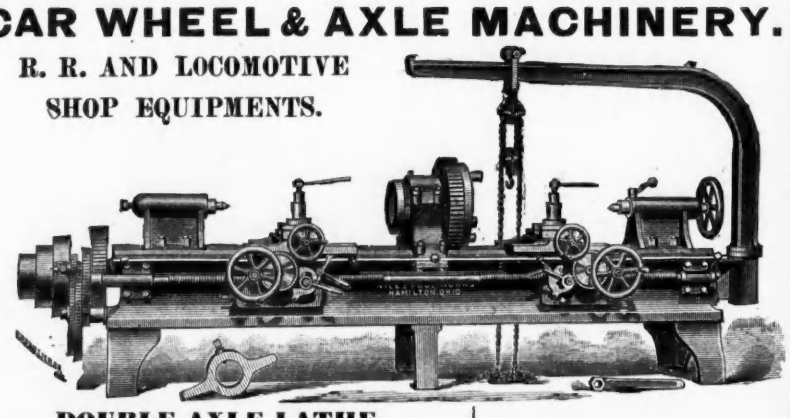
INVOLUTE GEAR CUTTER. SIDE MILLING CUTTER. FORMED CUTTER.

Coincident with the rapid and wide extension of the use of Milling Machines, has come an increased demand for Milling Cutters. Without good cutters, the efficiency of Milling Machines is much abridged.

In extending the product of its Milling Department, the BROWN & SHARPE M'F'G Co. has made many new varieties of Milling Cutters, and in order to supply the wants of customers, has found it necessary to greatly increase the number carried in stock. The INVOLUTE GEAR CUTTERS in stock are from 3 to 48 pitch, 8 cutters to each pitch. The Epicycloidal are from 2 to 10 pitch, 24 to each pitch. The curves of gear cutters are obtained by machinery. SIDE MILLING CUTTERS, from 3 1-2 in. to 8 in. diameter, are carried in stock. On work having parallel surfaces, these cutters may be used in pairs FORMED CUTTERS, for cutting various outlines, are made to order. These, as also the Gear Cutters, can be sharpened without changing their original form—a feature appreciated by those producing work in duplicate. By making cutters in large numbers, with expensive special tools, much greater accuracy has been attained than can be reached by the usual methods of manufacture. Users of cutters will generally find it more economical and satisfactory to purchase from experienced makers, rather than to attempt to manufacture for themselves. Catalogues mailed on application. All kinds of cutters made to order.

## CAR WHEEL & AXLE MACHINERY.

R. R. AND LOCOMOTIVE SHOP EQUIPMENTS.



DOUBLE AXLE LATHE.

**NILES TOOL WORKS,**

HAMILTON, OHIO.

NEW YORK, 96 Liberty St.
PHILADELPHIA, 705 Arch St.
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## CRANES OF ALL TYPES AND CAPACITY

FOR HAND OR POWER.

*SWING, PILLAR, LOCOMOTIVE, DERRICK, JIB, WALKING, TRAVELING, TRAM.*

PARTICULARS ON APPLICATION.

THE YALE & TOWNE MFG. COMPANY,

STAMFORD, CONN.

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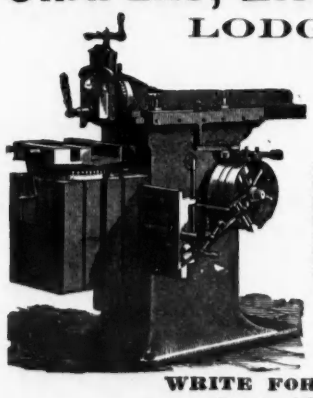
## SHAPERS, ENGINE LATHES & DRILLS.

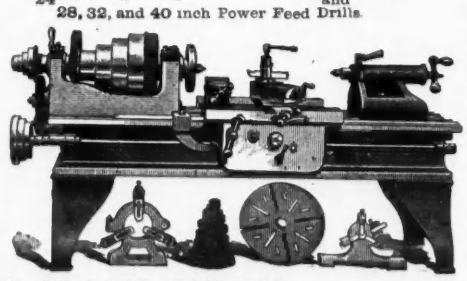
LODGE, DAVIS & CO.,

CINCINNATI, OHIO.



SHAPERS, 8", 10", 15", 20", 26", 32" Stroke.
ENGINE LATHES, 17", 19", 21", 24", 27".

20 inch Upright Drills. 25 inch Back Geared and
24 " " "
28, 32, and 40 inch Power Feed Drills.



WRITE FOR PRICES, IT WILL PAY YOU.

(See special notice of Engine Lathes on page 15.)

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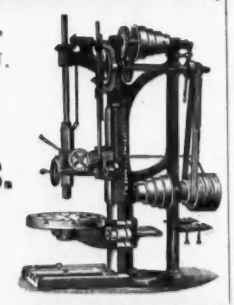
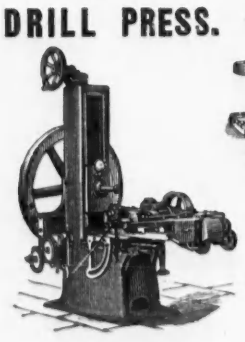
EBERHARDT'S PATENT DRILL PRESS.





EBERHARDT'S Patent GEAR CUTTER.

Sizes, 18", 25", 36", 50", 60", 84".

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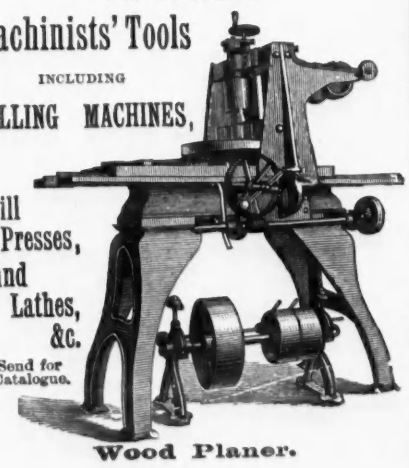

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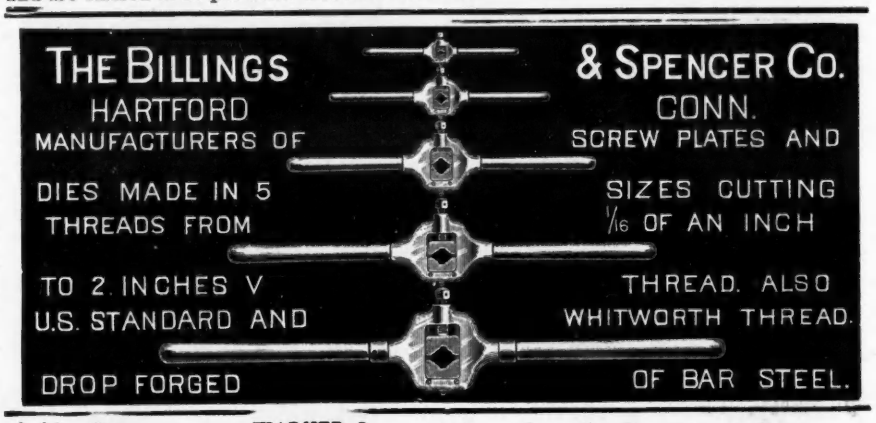

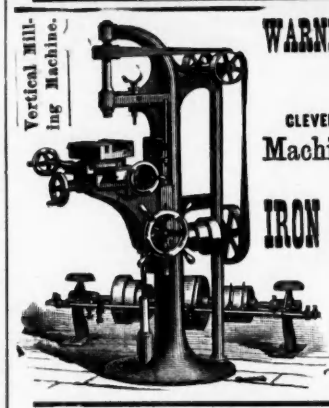

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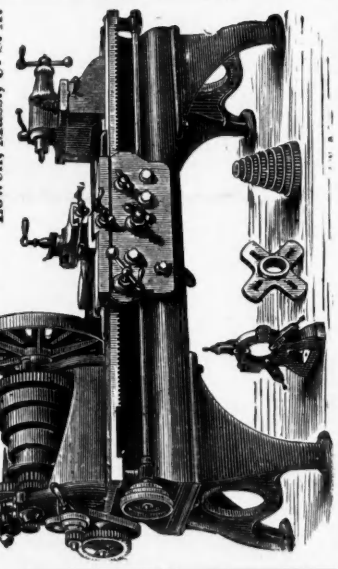

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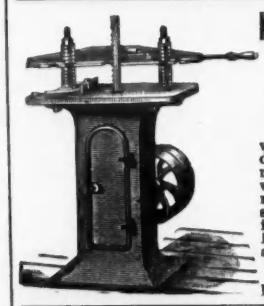

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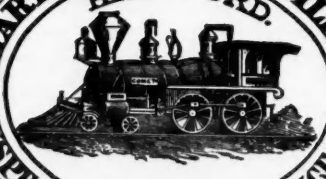

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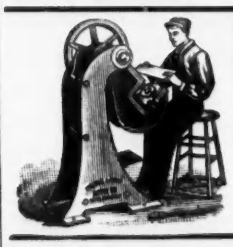

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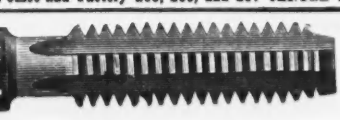

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